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REPORT

OF THE

PROCEEDINGS

OF THE

TENTH ANNUAL BLISTER RUST CONFERENCE

HELD IN

WASHINGTON, D. C.

FEBRUARY 18 TO 23, 1925.

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PROGRAM

TENTH ANNUAL BLISTER RUST CONTROL CONFERENCE
February 18 to 23, 1925
Washington, D. C.

Wednesday, February 18

A. M.
9:30 - - - - Office of Blister Rust Control, Building F 7th St., and the Mall

10:00 - Address of welcome - Mr. Detwiler

10:20 - The program - Dr. Martin

11:00 - Research activities of the Forest Service - - - - - - - - - Mr. Clapp
Extension Conference, conference room, 220 14th St., S.W.

P.M.
2:00 - Ribes substitutes, conference room 220 14th St., S.W.- - Mr. Darrow

3:30 - Methods of exhibiting products of wood using industries- Mr. Watkins
National Museum

Thursday, February 19

A. M.
9:00 -Office of Blister Rust Control

9:30 - The work of the Bureau of Plant Industry - West Wing - - Dr. Taylor

10:00 - Conduct of the Bureau's business - - - - - - - - - - - - - - Mr. Allanson

10:45 - Pathological collections- - - - - - - - - - - - - - - - - - - Dr. Shear

11:00 - Extension work in plant pathology- - - - - - - - - - - - - - Mr. Meier

11:15 - Short visits to nearby points of interest.

P. M.
1:30-4:30 - Symposium on pest control work - - - - - - Director Campbell
conference room, Bieber Bldg. Chairman
(30 minutes for presentation and discussion of each paper)

Regulatory functions of the Department - - - - - -Director Campbell

Cattle tick eradication - - - - - - - - - - - - - - - -Dr. McKellar

Rodent control -Mr. Henderson

Japanese beetle control- - - - - - - - - - - - - - - -Mr. Smith

Cedar apple rust control - - - - - - - - - - - - - - -Dr. Waite

Wheat rust control - - - - - - - - - - - - - - - - - -Dr. Kempton

Friday, February 20

A. M.

9:00 - Office of Blister Rust Control

9:15-12:30 - Certain research activities of the office of Forest Pathology- - - - - - - - - - - - - - - Dr. Metcalf Chairman

Methods of identifying Ribes rusts by inoculation - Mr. Hahn Greenhouse

Blister rust scientific investigations - - - - - - -- Dr. Metcalf conference room, Bieber Bldg.

Status of chestnut blight - - - - - - - - - - - - - - - Mr. Gravatt

Longevity of blister rust teliospores and sporidia- Dr. Spaulding

Inspection of sporidia measurement apparatus, historical blister rust specimens and the microscopic examination of spore stages of the rust in laboratory of the Office of Forest Pathology- - - - - - - - Dr. Metcalf

P. M.

2:00-4:30 - Certain extension activities of the Department- - - Mr. Collingwood Chairman conference room, 220 14th Street, S.W.

Farm forestry - Mr. Collingwood

Educational methods - - - - - - - - - - - - - - - - - - Mr. Graham

Newspaper writing - - - - - - - - - - - - - - - - - - - Mr. Russell

7:30-- Motion picture work of the Department - - - - - - - - Mr. Perkins
This will include an exhibition of several films illustrating the work of the Department and the kind of pictures that are made.

Saturday, February 21

A. M.

9:00 - - - - - - - - - - - - - - - - - - -

P. M.

1:30 - The work of the Forest Service – 930 F Street, N.W. - - - Mr. Carter
Informal.

2:00 - Inspection of atlas, map and chart rooms and lantern slides at Forest Service. The remainder of the afternoon will be used for visiting specialists of the Forest Service - Mr. Collingwood

5:30 - Informal get-together for supper and smoker - - - - - Harvey's Restaurant

Monday, February 28

A.M.

9:30 - General round table discussion of blister rust control problems, Office of Blister Rust Control - - - - - - - - - Dr. Martin
Chairman

FOREWORD

The Conference was opened by Mr. S. B. Detwiler, who extended a cordial welcome to the state leaders and others attending the sessions. Dr. Martin then briefly explained the program.

Previous blister rust conferences have been held in New England and New York and this is the first one to be held in Washington. It was designed primarily for the state leaders, to give them contact with the Bureau's administrative officers and scientific personnel engaged in blister rust control and similar lines of service work. Also, it was felt that such contact would be of special aid to state leaders in the discharge of their supervisory duties in the cooperating states, give them new suggestions and ideas to apply locally and in general better fit them to carry on the cooperative work.

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REGULATORY FUNCTIONS OF THE DEPARTMENT

By

W. G. Campbell,

Director of Regulatory Work, U. S. Department of Agriculture.

- - - - - -

The Department of Agriculture in its early days provided for no regulatory work. However, by Congressional Acts and as riders to appropriation bills for the Department, regulatory work of various kinds has been added to the scientific or investigational work and the extension or educational work already being carried on.

The extent to which the Department's activities are now regulatory is very little realized. Of $40,000,000 expended by the Department for the fiscal year 1923, more than half was spent in the enforcement of regulatory laws. It may be a matter of surprise that so much of the Department's work consists of law administration. This fact furthermore may not be in accord with the ideas prevailing in some quarters concerning the purpose of the Department. It seems to me, however, such doubts as may be entertained on that score can be effectively settled when the nature of the laws administered, and the purpose of their assignment by Congress to the Department of Agriculture, are considered. All of these laws have a direct and real bearing upon agriculture. The purpose of the Department is not only to encourage and foster agriculture as an industry, but to protect it. It was in recognition of this fact that the Department of Agriculture was indicated as the specialized enforcement agency.

The results derived through the administration of some of the regulatory laws are immediate, from others, less apparent but nevertheless

real. While all of these laws possess regulatory aspects, including even those of a service nature, they are, however, corrective rather than penal statutes. They naturally group themselves under a classification determined by the type of authority conferred upon the Department as the effective means of their administration. Some of these such, for instance, as the plant quarantine act, give to the Secretary very broad powers. Under the terms of that law the Department can supervise traffic in not only those products which may act as hosts to the pest or to the disease, but may inspect every article of commerce which may serve as a medium for the transportation of the scourge. This particular act is a preventative statute and occupies among all of the other laws a rather unique position because of this fact and the rather unlimited authority which the Department may exercise in its enforcement.

Almost all of the other laws designed for the regulation of agencies or intermediaries between the producer who is the farmer, and the ultimate consumer, authorize the visitation of penalties only after the commission of offenses. Laws of this nature can be illustrated by the Food and Drug Act, the Insecticide and Fungicide Act, the Packers and Stockyards Act, and the like.

There are, finally, those statutes which may be said to be not so much laws of controlling character, but laws which on account of the optional feature are designed to benefit interested agencies engaged in the production and marketing of agricultural products. These laws represent an advanced tendency toward regulation by standardization. The Grain Standards Act does not make it compulsory, for instance, for all grain covered by this law to be graded and to be sold under such grades. It leaves entirely to

the election of the shipper a determination of whether or not he will avail himself of this opportunity, and prescribes certain regulatory conditions in the event that he does.

It is only a short step from laws of this type to those distinctly service in their nature, such as the Food Products Inspection Act. This law is one which was intended to create advantages in marketing farm products and deals with those commodities which are marketed in their natural state. In such circumstances there is less necessity for the incorporation of the regulating provisions and severe penalties because the opportunity for sophistication has been very materially diminished if it has not disappeared entirely.

Scientific research is found in, and is intimately connected with, every law enforcement act administered by the Department of Agriculture. No clean cut distinction can be made between scientific work, extension work, or regulatory work.

Regulatory work of the Department is a logical outgrowth of its research and studies, and most of the measures are educational in basic purpose, framed in an effort to establish an understanding and acceptance of standards which have been deemed desirable. This trend is especially notable in the service regulatory work.

CATTLE TICK ERADICATION

By Dr. W.M. MacKellar
Assistant Chief of Tick Eradication Division
U. S. Bureau of Animal Industry.

Dr. MacKellar briefly reviewed the history of the disease, Texas, southern, or tick fever in cattle, explaining that it was one of the old animal diseases reported from many parts of the world and was probably introduced by cattle imported by the Spaniards during the early colonization of Mexico and southern United States. He explained the successive steps taken by the Department of Agriculture in investigating and controlling this cattle plague, which lead to the discovery by investigators of the Bureau of Animal Industry that the cattle tick was essential in the transmission of the disease, and points out that this was the first experimental proof furnished on the subject of diseases showing they could be carried from one animal to another by insects.

The early methods of control, the Federal quarantine line across the United States separating the tick-infested from the tick-free sections, and the investigations made in an effort to find a suitable disinfectant or dip, were described. It was shown that these investigations lead those interested in this work to believe that it was feasible and practicable to eradicate ticks from the United States, and that on July 1, 1906, the first appropriation by Congress for tick eradication became available and the work was taken up on a country-wide basis.

In explaining the nature and extent of the cooperation by those interested in this work, it was shown, that the work was always carried on

as a cooperative project by the States, counties, cattle owners, and Bureau of Animal Industry. The States enacted the necessary laws and provided for their enforcement and also as a rule furnished a portion of the inspection force. The counties usually supplied the dipping vats, furnished the dipping solution, and employed the local inspection force. The cattle owners are required to gather and bring their cattle to the vats, supplied by the county, and to do the work incidental to dipping them. The Bureau of Animal Industry maintains a central office, taking care of the records and general organization, and furnishes sufficient expert supervision.

Educational work, it was explained, is an important part of this project. Satisfactory results are always more promptly obtained when those interested in the work understand its object and realize the benefits that will follow its successful completion. In tick eradication a number of Department bulletins, circulars, and posters are used in giving information regarding the tick, the disease it transmits, and successful methods for its eradication. One popular publication has been especially prepared for children, with a view of reaching the cattle owners through the younger members of the family. Rural meetings and the use of especially prepared Department films for motion picture exhibitions are also extensively used in disseminating information and preparing communities for actual systematic tick eradication. Well informed men employed in supervising the work are an important factor in disseminating information. They being in constant touch with the cattle owners throughout the area in which the work is in progress, meet the individual objections and by giving

information are often able to prevent and remove them.

The regulatory work conducted by the Bureau of Animal Industry in connection with tick eradication, is principally in connection with the interstate movement of cattle from the quarantined area with a view of preventing the spread of Texas, southern or splenetic fever in cattle, and is conducted under the provisions of Department regulations governing the interstate movement of livestock.

The extent of this work was indicated by figures for the fiscal year 1924, showing that during that year over 28,000 dipping vats were in use and that there were 39,845,189 dippings of cattle. The results obtained in this work since its inauguration are briefly summarized in the following statement:

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Animal Industry
Washington, D. C.

STATEMENT OF RESULTS - Tick Eradication - July 1, 1906, to December 15, 1924.

STATES	Counties Quarantined		Counties Released	Released Counties Tick-Free		
	July 1, 1906	Dec. 15, 1924	to Dec. 15, 1924	Nov. 1, 1922	Nov. 1, 1923	Nov. 1, 1924
Alabama	67	8	59	15	26	41
Arkansas	75	37	38	16	21	34
California	15	0	15	15	15	15
Florida	58	53	5	3	3	1
Georgia	157	0	157	101	119	138
Kentucky	2	0	2	2	2	2
Louisiana	65	38	27	3	3	4
Mississippi	81	23	58	37	47	54
Missouri	4	0	4	4	4	4
North Carolina	75	7	68	40	46	53
Oklahoma	61	5	56	35	47	49
South Carolina	44	2	42	29	35	36
Tennessee	42	0	42	41	41	42
Texas	199	98	101	44	49	56
Virginia	30	4	26	*	*	*
Total	975	275	700	385	458	529

*No Bureau cooperation from Nov. 1, 1922, to Nov. 1, 1924.

RODENT CONTROL

By Dr. W. B. Bell

Bureau of Biological Survey, U. S. Department of Agriculture

Extracts from Address -

It is little realized by the people of the country, and even by those in the Department of Agriculture carrying on other plant pest campaigns, that the loss in crop production in the United States from rodents mounts up into the hundreds of millions of dollars annually. In 1920 this loss was estimated at $500,000,000.00 per year.

Because of the number of rodent pests and their widespread distribution they cause heavy losses of farm crops, and forage grasses, also in orchards, vineyards, truck farms and nurseries.

Cooperation -

Investigations by the Biological Survey have determined successful methods of reducing the number of rodent pests, and plans have been devised for large-scale organization of systematic field operations to this end. Federal, State, and local agencies are so correlated that the work of clearing great areas can be conducted in an orderly way. The work has been supported consistently by farmers and stockmen, as the direct benefits evident from it appeal to their business judgment. Large-scale operations have been greatly facilitated through the hearty cooperation of the Office of Cooperative Extension Work and the State extension service organizations, including the county agricultural agents and State and county farm bureaus.

State department of agriculture, county commissioners, and many agricultural, horticultural, and livestock organizations have taken an increasingly active part in the undertaking, and officials of the Forest Service, the Office of Indian Affairs, and the Reclamation Service cooperated most helpfully on their lands. The bureau continues to cooperate with the United States Public Health Service of the Treasury Department, and with State, county and municipal health organizations in lines of work where rodents are important agencies in the dissemination of such diseases as bubonic and pneumonic plague, Rocky Mountain spotted fever, and tularaemia.

Prairie Dogs and Ground Squirrels. -

From the earliest settlement of the mid-West and the Western States the ground-squirrel and prairie-dog problems have confronted the farmer and stockman.

Campaigns organized to combat prairie dogs and ground squirrels during the past year (1923) covered 8,000,000 acres of Federal and private lands, which were given a first treatment with poisoned baits, and follow-up work with poison or fumigants on previously treated areas was done on 6,000,000 acres. This makes approximately 12,000,000 acres of Federal and 105,000,000 acres of State and private lands on which a large percentage of these pests have been poisoned since 1916 in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming.

It is estimated that a saving of more than $4,000,000 was accomplished during 1923, bringing the total estimated saving of crops and forage since this work was started on a large scale in 1916 up to $72,000,000.

Many counties have adopted the plans proposed by the Biological Survey for coping with prairie dogs, and 11 counties in three States are reported as being free from them. Many others are from 95 to 98 per cent cleared, and other large units have adopted the plan of an intensive three-year campaign for the extermination of these rodents. From 75 to 95 per cent of the prairie dogs or ground squirrels are usually destroyed by the first poisoning treatment. Getting all the remaining survivors at times proves a difficult undertaking, but the work is being pushed with determination, and poisoning is being followed up with the use of carbon bisulphide and other fumigants. Marked improvement is reported in forage production on grazing areas which have been cleared.

Pocket Gophers -

Skepticism as to the possibility of eradicating these ground-burrowing rodents at a reasonable cost is being eliminated with success attending trapping and poisoning demonstrations.

In Idaho four counties used 1,280 quarts of bait on 46,000 acres, getting about 80 per cent of the animals with the first treatment, and 35,000 acres that were given a second treatment showed about 95 per cent kill.

A number of demonstration farms have been used where areas are cleared of the pocket gophers and where farmers of the vicinity learn the methods employed and see the benefits resulting from eradication of these pests. Such demonstrations are leading many farmers to undertake to clear their land.

Jack Rabbits and Cottontails -

In localities where the animals were doing serious damage, effective

control work was accomplished through poisoning operations and the organization of drives.

The fact that the Snow Shoe Rabbit causes considerable damage in forest plantations may be of especial interest to you who are engaged in control of the blister rust, a pest I believe of pine plantations as well as of older trees. According to the Forest Service the snow shoe rabbit is a serious pest in northern Minnesota. They report that

"Not only are the tips and needles of planted trees eaten by the rodents, but much of the natural young growth of pine, spruce, aspen, and maple is cut back and defoliated or barked near the base if the trees are over three feet high. Of the three principal species planted-white pine, Norway pine, and white spruce - the damage is heaviest in the white pine and least in the spruce. All three, however, are so heavily damaged as to cause death in the case of any of the trees whose tips can be reached above the surface of the snow by the rabbits. It is reported that 79 per cent of the trees in one plantation were eaten off by the rabbits, 43 per cent fatally. In another instance practically the whole plantation of white pine was destroyed by the rabbits."

Other Rodent Pests -

The Biological Survey also has to deal with such other rodent pests as Woodchucks, field mice, cotton rats, kangaroo rats, house rats and mice.

Publications dealing with the control of these pests may be secured direct from the Division of Publications of this Department. Inquiries which you men engaged in Blister Rust Control might receive concerning protection from rodents should be forwarded direct to the Bureau of Biological Survey.

Japanese Beetle Control Work

By

Loren B. Smith, Entomologist,

Japanese Beetle Laboratory, Riverton, N. J.

The Japanese beetle was introduced into the United States from Japan some time within a 2 or 3-year period prior to 1916. During that summer, 12 adult beetles were found by inspectors of the New Jersey Department of Agriculture in a nursery near Riverton, N. J. Since then it has spread outward at an average annual rate of 12 to 15 miles each year until at the close of the summer of 1924 the known infested area amounted to approximately 5122 square miles.

This insect is closely related to certain of our native May beetles and its habits and life-history are similar in many respects to the common rose beetle. The adult beetles appear usually about the middle of June and are present until the middle of October. During that time the beetles feed on a wide variety of plants, over 200 species having been listed in New Jersey. The female beetles deposit their eggs in the soil in batches of 2 to 5 eggs and they lay a total of about 60 eggs. The eggs hatch within a week or ten days and the young grubs feed within an inch or two of the surface of the soil, on the roots of grasses and other plants. The insects have become so abundant that as high as 1500 grubs have been found to a measured yard. Under conditions of heavy infestation severe damage has resulted to lawns and golf courses within the infested area. The larvae become full grown by the first of November and descend to a depth of 5 to 6 inches in the soil, where they pass the winter.

Feeding is resumed in the spring and the grubs pupate in May, and begin emerging as adults in June. The adult beetle is primarily a pest of fruit and ornamental trees, plants and shrubs. It attacks the fruit and foliage and has caused a considerable loss to early ripening varieties of apples, peaches and plums. It also attacks the flowers and foliage of roses and other ornamental plants as well as the foliage of shade trees, such as lindens, elms, maples and oaks. The injuries which it causes resemble the work of the rose beetle, the leaves are skeletonized and the soft portions of the fruit are eaten. During the time that the insect has been in this country it has found excellent conditions for reproduction and spread, and as a result has increased in enormous numbers.

During the summer of 1918 a quarantine was placed on the movement of sweet corn out of the infested area by the New Jersey Department of Agriculture. This resulted from the fact that the adult beetles feed on the silk of corn and work down into the husk, and thus are easily transported. In 1919 the Federal Horticultural Board inaugurated quarantines restricting the movement of several articles of farm produce as well as the movement of nursery stock and soil from the infested area. The Bureau of Entomology has undertaken the leadership in a cooperative campaign to restrict the movement and effect control of the Japanese beetle. Funds are contributed by the States of New Jersey, Pennsylvania and Delaware as well as by the Federal Government. A laboratory is maintained at Riverton, N. J., where investigations are being conducted with reference to various phases of control as well as for the operation of the quarantines. An

advisory committee, composed of representatives of the cooperating States and the Bureau of Entomology direct the general policies of the work, these policies being carried out by a staff of experts maintained in the field. Since the spread of the insect has been confined to an enlargement of the original area the headquarters for the work thus far have been maintained at Riverton, which occupies a central position with respect to the area infested. The Project is now divided into 4 main divisions of supervision, farm products quarantine, nursery quarantine and scouting and research, the research work in turn being sub-divided into several main lines, with an expert in charge of each.

Considerable publicity and educational work has been carried on during the past several years which has consisted of personal conferences with the growers, publication of literature dealing with the problem, meetings of growers and others affected by the quarantines as well as general meetings of growers held for the purpose of discussing measures of control.

The Federal Department has maintained a research laboratory for the purpose of developing measures of control for the insects in its several stages. It was found several years ago that the usual methods of spraying were not effective in killing the Japanese beetle. As a result a large amount of investigational work has been necessary to devise new methods of control, both for the adult insect and for the grub where it occurs in the soil. In addition several methods have been devised for the treatment of soil about the roots of plants which are designed to kill any grubs present without injury to the plant. In this way it is possible to treat nursery stock which will render them free from infestation and permit ship-

ment to points outside of the area. In 1920 investigators were sent to Japan for the purpose of collecting, rearing and shipping to this country the parasites which occur on the Japanese beetle in its native home. This work has been continued with great success, and at the present time one species of parasite is known to be established in this country, with a possibility that two other species may have been established from releasements made in 1924. During the past season an insecticide was also developed which promises to be exceedingly effective in destroying the adult beetles. This consists of a special preparation of arsenate of lead which has unusually good adhesive qualities, and which will cost but little more than the usual sprays.

Since the inception of the quarantine against the Japanese beetle in 1919, regulations provided by the Federal quarantines as well as quarantines promulgated by the States of Penna., and New Jersey have been enforced. This work has included the inspection of farm products, particularly green or sweet corn, cabbage, lettuce, grapes, hay, straw and forage crops as well as a large number of commodities of farm produce emanating from the Philadelphia markets. Until the summer of 1923 Philadelphia was not included in the infested area. During that year the unrestricted movement of farm products was permitted from the infested area to the Philadelphia market. Thousands of beetles were carried to the market daily on corn and other produce, with the result that the beetles crawling from the corn were likely to infest any adjacent articles of produce. As a result, during the season of 1924 restrictions were maintained on all articles of farm produce emanating from the city of Philadelphia. The general procedure in the operation of the farm products quarantine has

been to inspect the restricted articles at the point of origin or on the farm. After inspection the articles are certified for shipment out of the infested area. For this purpose offices are maintained at strategic points throughout the infested area and inspectors are furnished on call to the growers desiring to make shipment. In the case of the city of Philadelphia, 3 inspection centres were maintained where it was possible for a shipper to haul his produce, have it inspected and certified for shipment. It was found that certain articles of produce could not be inspected owing to the fact that they could not be handled without injuring their quality, or they could not be inspected owing to the character of the product. For this reason certain articles were not certified under inspection. As a means of preventing contraband movement of such articles inspectors were stationed on the highways leading out of the infested area, whose duty it was to stop all traffic to make assurance that no contraband shipments were being made. In Pennsylvania it was possible to obtain the services of two troops of the State Police, who assisted our inspectors at night in stopping automobiles and trucks. During the summer of 1924, 31 State Troopers were assigned to the Japanese Beetle Project. As an additional check, inspectors are maintained in the larger markets outside of the infested area such as New York, Brooklyn, Baltimore, etc., whose duty it is to check on incoming produce to make assurance that no beetles have escaped the inspectors or have been carried to these markets on any contraband produce. During the summer of 1924 over 68,000 beetles were removed from approximately a half million bags of sweet corn which were inspected by the quarantine service. Over 1,300,000 baskets of tomatoes were certified for shipment from the State

of New Jersey to points outside of the infested area. The shipment of hay, straw and forage crops, which cannot be readily inspected, is prohibited during the period when the beetles are on the wing. The farm products quarantine is operative only during this period, which extends from June 15 to October 15 and is designed primarily to prevent the movement or carriage of the adult beetles to points beyond the range of their flight.

Philadelphia represents the centre of one of the largest nursery and greenhouse districts in the United States. Nearly all types of nursery business are represented in this region. There are in the area now under quarantine approximately 1500 nurseries and growers of ornamental plants. Approximately one half of the nursery stock grown in the restricted area consists of evergreens. Large quantities of outdoor grown perennials, such as phlox, iris, dahlia, peony, etc., are propagated and shipped from the quarantine zone. Fruit stock is a small item.

The infested area is determined each year by summer scouting. It has been the policy since the quarantine was incepted to include in the quarantined area a border zone one township in width beyond the outermost point where infestation has been found. This is done as an additional safeguard since it would be most difficult to find the absolute limits of infestation. For this reason nurseries throughout the general Japanese beetle area fall into different classes with respect to the danger. Class I consists of nurseries which so far as can be determined, are entirely free from infestation, either by adult beetles or by larvae in the soil. Class II nurseries are those in or near which a single adult beetle has been found but in which no soil infestation has been determined. Class III nurseries are those in which both the adult beetles and

the grubs in soil have been found to occur.

Nurseries of the first class are those usually in or near the safety border zone of the Japanese beetle area and in townships or districts where neither beetles nor grubs have been found. Nevertheless, such districts and nurseries, etc., are kept under close observation in connection with the general beetle survey. With the nurseries of this class, blanket certification is made for the movement of stock and a supply of numbered certificates for such purpose is issued to the nurserymen.

With respect to nurseries of the second class, nursery stock with soil may be certified at the discretion of the chief inspector for shipment outside of the Japanese beetle area under the following safeguards:

(1) As a basis for determining their grub-free status, careful and frequent diggings are made throughout the nursery blocks, and if any grubs are found the nursery in question is immediately placed in the third class, and further certification of shipments with soil from such nursery is refused.

(2) As an additional safeguard with respect to nurseries of the second class, all nursery stock shipped with soil is inspected at the time of digging, such inspection involving careful examination of the soil removed, as well as of the hole which is made in the digging of the plant. In addition to such examination two or three inches of surface soil are removed from about the plant for the reason that during September and October and April and May, representing the two chief shipping

periods for evergreens and other balled plants, any grubs if present would during these months be most likely to occur near the surface.

With respect to nurseries of the third class, no nursery stock, etc., is allowed to be shipped out of the Japanese beetle area with soil except in the case of certain classes of plants where it is possible to treat the soil under methods later referred to which have been determined as being 100 per cent effective in killing the grubs.

Nursery Stock Without Soil.

Under this heading is included deciduous stock which can be and is usually shipped without soil and such evergreen stock as can be shipped without soil. All stock from which the soil has been entirely removed by shaking or washing so that the roots are clean and can be inspected is permitted to be shipped under inspection and certification from any part of the Japanese beetle area. In the case of plants grown in light, sandy soil, it is usually unnecessary to wash the roots but in no case is any plant certified for shipment to points outside of the infested area which is of such a nature that it can not be properly inspected to insure its being free from any grubs.

Outdoor-Grown Ornamentals and Plant Roots.

Included under this heading are such plants as iris, phlox, peonies, ivies, honeysuckles, and similar outdoor-grown plants which are normally shipped without soil. Such plants and plant roots are permitted to be shipped outside of the Japanese beetle area provided all soil can be removed from the roots by either shaking or washing and proper inspection made to insure freedom from infestation. In some

cases, however, it has been found that a satisfactory inspection can not be made, even after the plants have been washed, and certification is refused as to such plants except where it is practicable to treat the roots with carbon disulphid or wormseed oil emulsion, which destroys the grubs, and permits certification for shipment. This applies to nurseries, etc., coming under the second and third classes as discussed above.

To qualify for certification and shipment outside the Japanese beetle area, all greenhouses falling within the second and third classes, as above, must meet the following requirements:

(1) All doors, windows, and ventilators must be screened in a manner satisfactory to the inspector of the Department of Agriculture.

(2) All stock must be grown in grub-free soil--the soil being either treated with carbon disulphid or steam, or else obtained from outside of the Japanese beetle area. Such sterilized or imported soil must be stored in tight houses where it can not become infested during the summer.

(3) If plants so potted are kept in beds in the open after the beetle season, a fine mesh screen must be placed in the bottom of each pot to prevent even the remote chance of grubs entering through the drainage hole, and in addition the beds on which these pots are placed must be poisoned with arsenate of lead at the rate of 1,500 pounds to the acre well worked in--a treatment which has proved to be a very efficient means of killing grubs in the soil.

Lists of all shipments made to points outside the Japanese beetle area are required from shippers of nursery, greenhouse stock, and plants of all kinds. These lists give information as to the quantities and types of stock being shipped and the name and address of the party to whom the same is sent. Such lists are surrendered weekly by the various firms and individuals making shipments. In addition to this, lists are required of all transactions within the area between dealers in the various kinds of stock, thereby giving an additional check on the movement of quarantined articles which might ultimately be shipped out.

When the nursery quarantine was first applied several years ago it was realized that an embargo on the movement of nursery stock with soil about the roots, out of the Japanese beetle area would work a serious hardship on nurserymen and others located in the area infested or which would soon be infested. The policy was adopted that providing treatments were found which would entirely free the soil from infestation, plants with soil about the roots would be certified for shipment after they had been treated and all infestation destroyed. It then became a problem of devising methods of soil treatment which would give a complete kill of the grubs without injury to plants. At the time these investigations were undertaken little was known concerning treatment of soil under such conditions, and much preliminary work had to be done before a method was found which would serve the purpose desired. After various measures had been tried without success the possibilities narrowed down to the use of a chemical. Long and de-

tailed experiments were performed with many materials. This resulted in developing the use of carbon disulphide (CS_2) as a soil insecticide for the control of the Japanese beetle. It was found that exceedingly small dosages of this chemical were extremely toxic to the immature stages of the insect and to obtain a uniform distribution through the soil it became necessary to employ some dispersing agent, such as water. Since carbon disulphide is relatively insoluble in water a homogenous emulsion was prepared which contains 71.4 per cent carbon bisulphide. The dilution and volume of dilute solution applied to the soil depend upon the soil temperature, kind of soil, class of plant to be treated, etc. An emulsion of oil of wormseed was also found to possess high toxicity on the Japanese beetle grubs. It is more costly than carbon disulphide and is used only in the case of a few species of matted-root perennials which will not withstand treatments of carbon disulphide.

APPLE CEDAR-RUST CONTROL.

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(The following is an abstract of the paper presented.)

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This paper outlined the life of the apple cedar rust fungus Gymnosporangium juniperi-virginianae. The methods of control were discussed and comparisons were drawn between this disease and the white pine blister rust and other rust fungi. Diagrams, photographs and colored illustrations were used to illustrate many of the points.

The common cedar rust of apples with its alternate generation on the red cedar is a true rust having many points of similarity to blister rust, though the fungus belongs to a different group of the Rusts and there are several important differences. Though both diseases are controlled by eradication of the alternate host, the methods of control, including the method of attack in dealing with blister rust by the application of quarantine laws, have been considerably different. These differences, it is pointed out, go back to the fundamental facts concerning the life history, origin and distribution of the fungus parasite causing the disease.

The group of fungi to which the apple cedar rust belongs, the Gymnosporangi, bear their teleutospores on the sub-family of conifers, Juniperinae, and with one exception bear their cluster cup or aecidioform on the family Pomacae. There are several other lesser cedar rusts of little economic importance on the apple and there are several cedar

rusts of pears, quinces, service berries, hawthorns and other related fruits.

Besides the mycelial or vegetative form, the rusts have four possible fruiting bodies: 0, I, II and III. 0 is the spermogonium form which almost always accompanies I, the aecial form. II is the uredial form and III, the teleuto form. One or more of these forms may be missing from the rust cycle. The various possibilities of the make-up of rusts were indicated on the diagram. The cedar rust of the apple consists of 0, I, and III; the uredo form II, is missing. On the other hand, with the white pine blister rust, as with the wheat rust, all four sporeforms are present.

In the cedar rust, therefore, there can be no multiplication on either host independently - the fungus can only propagate by direct transfer from the cedar galls to the apple and from the apple back to the cedar again. While it may spread viciously under conditions favorable for direct infection, colonies cannot multiply either on the red cedar or on the apple. Slight infections, therefore, within the cedar rust areas are of little consequence, only the heavy infections become important.

The galls on the red cedar, the little brown balls, exude gelatinuous spore masses in the spring about the time the apples come into bloom or when buds begin to show pink. These spore masses swell out and germinate in the spring rains. Each half spore or single cell may germinate into a promycelium which becomes four-celled and each cell produces a very minute sporidium on the end of each stalk. These minute sporidia are freely blown by the wind and though they are very perishable may

reach considerable distances, that is several miles. Under favorable conditions, which mainly consist of spring showers and moist, cloudy weather, the sporidia germinate on and infect the young newly formed apple leaves. After a week or so, a large, yellow, thickened spot appears where infection has taken place. This slowly grows from about an eighth to a quarter inch in diameter and in a little less than two months the spot has reached sufficient maturity to produce the cluster-cup or aecidial form with the aecidiospores. The thickened, orange spots on the apple leaves at this stage have a distinctly rusty appearance on the under side and the minute dark-colored spermogones show on the upper side of the leaves. Similar spots are formed in less abundance on the fruit of the apple and occasionally even on the young tender one-year old twigs. The form on the apple fruits may or may not produce cluster cups or may develop them later in the season. Slightly infected leaves may persist and function and have only a small effect on the quantity of apples borne by the tree but a heavy infection of the foliage causes it to drop off by mid-summer or later, when winter apples are not half grown. The result is that a fine prospective crop of apples may be reduced to mere culls.

During the summer the aecidiospores from the apple are transferred to the red cedars in the vicinity. The distance they are carried and the ease of transfer are not so well known but these heavier spores probably transfer much less freely than the sporidia from the red cedar form. The result is a dormant infection of the red cedar which does not show during the summer, fall or winter but develops into a gall during the following growing season, reaching approximate maturity during the autumn of the second year. The galls winter over and reach full maturity the second

spring so that they exude their spore masses, thus completing the two-year cycle. The fungus thus spends about four or five months on the apple and about one year and eight months on the red cedar.

This fungus is native on the Virginia red cedar, Juniperus virginianae and on a southern representative, Juniperus barbadensis, on the one hand, and on the three wild crab apples of the humid eastern half of the United States, Pyrus iowensis, Pyrus coronaria, and Pyrus angustifolia. It is very generally distributed east of the Great Plains. It began to attack the cultivated apple slightly some forty or more years ago, mostly limited to some special varieties, notably Pryor's Red in Virginia; but from about 1905 to 1908 at widely different points, namely Nebraska, Iowa and Virginia, it began to be serious as an economic disease. It increased rapidly in Virginia from 1908 to 1912, and later, mainly on the York Imperial. Its most abundant increase was during the even years. Finally, by 1919, the cycle of the odd years apparently caught up. It also increased its spread to other varieties in the Appalachian fruit belt.

Eradication of the red cedars was entirely successful and at first for even short distances of less than a half mile from the apple orchards, but as the quantity of infection increased, it became necessary to chop down the red cedars to the distance of two miles, and now it appears that even four miles may be necessary. The problem, however, of eradication is purely a local one.

The amount of infection on the apple depends upon two variable factors - volume or quantity of spores and distance. Theoretically, the number of sporidia which reach an apple tree from any given cedar is inversely as the square of the distance and we have abundant field evidence that this

works out approximately in nature, notwithstanding that wind currents and weather conditions considerably modify the result. That is to say, a cedar tree at any given distance, say ten rods from an apple, is four times as dangerous as one twenty rods away. On the other hand, large volumes of infection may overcome the distance factor; and four cedar trees would theoretically deliver the same volume of sporidia at 20 rods that one cedar tree would at ten.

The differences between these two similar heteroecious economic rusts may be outlined as follows: Cedar rust is a native disease, the fungus being native on the wild crab apples and wild red cedars, and widely distributed over its geographical range in the eastern United States. The blister rust fungus was introduced from foreign countries and is not completely distributed.

In case of cedar rust, the serious economic host, the cultivated apple, is an introduced plant. In blister rust, the most valuable host plant is the white pine, a native tree. With the cedar rust, the economic host, occurs in cultivated orchards and gardens, the alternate host being in the forest. With blister rust, the economic host is mainly a forest tree, and the alternate host is usually a garden plant but may be in the forest undergrowth.

Cedar rust has no uredo form and therefore can only reproduce by cross infection between the hosts. In case of cedar rust, the economic form is annual in its attacks; in blister rust it is perennial on the stem when once infected. Blister rust, like the wheat rust, has the uredo-form and can reproduce and multiply on Ribes as well as by cross-infection.

Control Measures.

While in general, the control methods for these two diseases are similar, that is by eradication of the alternate host, yet the differences, as pointed out above, profoundly influence the methods employed. Spraying has little effect on cedar rust, but thorough eradication of the red cedars within one to four miles of the apple orchards produces immediate and permanent results. It is a local and state problem, therefore, and since the Federal Government does not have jurisdiction over local destruction of red cedars, State laws, either cedar rust laws as in Virginia or West Virginia, or general pest laws, as in Ohio, Illinois, Arkansas and other States, are invoked in the eradication. One community or one county may be carrying on the work with success, while an adjacent community or an adjacent county is not doing it. Federal quarantine methods or other regulatory measures, therefore, have no important function, the duty of the Department of Agriculture experts being to give advice and information based on experience and scientific research. It has been pointed out that in forest reserves or in forests where it is desired to grow red cedars, apple trees or even wild crab apples should be eliminated. A neutral zone should be established between orchard districts and forest reserves where there are neither apples nor cedars. A few stray apple trees among the cedars may cause them to be heavily infested by the convenience of transfer of the fungus and thus enable a large number of spores to be carried to the moderately distant apple orchards.

BARBERRY ERADICATION AS A METHOD OF REDUCING STEM RUST LOSSES OF SMALL GRAINS

by

F. E. Kempton, Associate Pathologist in Charge of the Barberry Eradication Campaign, Office of Cereal Investigations, Bureau of Plant Industry, U. S. Department of Agriculture.

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BARBERRY ERADICATION AS A METHOD OF REDUCING STEM-RUST LOSSES OF SMALL GRAINS /a

by

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The barberry eradication campaign, as a means of controlling stem-rust epidemics, was started by the Office of Cereal Investigations, Bureau of Plant Industry, United States Department of Agriculture, in 1918. It is conducted in cooperation with the following north-central, grain-growing States: Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Wyoming. By eradicating the barberries from this area it is hoped to eliminate entirely the small local epidemics which are directly traceable to common barberries and to remove the many sources of inoculum of the large epidemics which frequently cause immense small-grain losses.

Similar barberry eradication campaigns have been carried on by many European countries in the last two hundred years. The most notable of these is the campaign begun in 1903 in Denmark where stem rust had previously done serious damage. That country banned barberries susceptible to stem rust, then made careful surveys and eradicated the bushes with the result that stem rust is seldom found. When stem rust is observed, the Danish farmer seeks out the offending barberry and destroys it immediately.

/a This paper was presented before the Tenth Annual Blister Rust Control Conference, Washington, D. C., February 20, 1925.

/b Credit is due Dr. E. C. Stakman, Agent in Charge of Stem-Rust Investigations, and his associates for information pertaining to stem rust and stem-rust spread and to the State leaders and cooperators in barberry eradication for data.

In parts of Germany, Austria, and France barberries were removed more than 100 years ago, and in England, too, stem rust no longer is a menace because of the more or less complete removal of susceptible barberries. The English farmer well knows that he can not grow profitably both susceptible barberries and wheat.

LIFE STORY OF THE STEM-RUST PARASITE

There are several stages of black stem rust, the cluster-cup or spring stage, the red or summer stage, and the black or winter stage. The difference in appearance of the rust at different times is due to the formation of different kinds of spores.

The cycle is as follows: The rust starts on the common barberry in the spring, forming the spring or cluster-cup stage. The cluster-cup stage can not spread from one barberry bush to another but spreads to grains and grasses. The red-spore or summer stage results. The red stage continues to develop and spreads from grain to grain as long as conditions are favorable, but can not spread to barberry. Late in the season the red stage is followed by the black stage. The black spores are dormant during the winter but they germinate in the spring and produce smaller spores (sporidia), which infect the barberry.

It is evident that the barberry gives the rust a chance to start in the spring and that the black spores are harmless unless there are barberry bushes near by.

DOES THE RED STAGE LIVE OVER WINTER?

For a number of years the U. S. Department of Agriculture has been studying the question of the overwintering of the red-spore stage. It is well known that the leaf rusts overwinter in the red-spore stage. The black stem rust does overwinter in the red-spore stage in the extreme South and on the Pacific Coast, where the stem rust can continue to develop on fall-sown grains practically throughout the winter.

Investigations have been carried on for a number of years to determine whether or not stem rust occurring in the red spore or summer stage can live over winter on fall-sown grains or on grasses. These studies have shown that the red spores of stem rust seldom overwinter in Oklahoma, Kansas, Missouri, Kentucky, Nebraska, or in any of the States farther north. All evidence available at present shows that if the red stage of stem rust does overwinter at all in the northern States, it does this so rarely as to be of little importance in starting rust epidemics. In the many tests extending over several years practically all of the red spores were found to die early in the winter. The freezing and thawing weather throughout the later winter and the spring rains with intervening dry spells kills the remainder. Stem rust develops on barberry plants in the North and spreads to grains and grasses just as early in the spring as stem rust begins to become general in the South.

STEM-RUST SPREAD.

Although viable stem-rust spores have been collected at high altitudes over rusted grain fields there is no evidence that shows that these spores travel from the Gulf States to the North and develop epidemics. Neither has it been possible to trace stem rust epidemics from field to field, State by State, from the Gulf States to the Dakotas. In the eastern States of the barberry eradication area where grains are usually fall-sown severe stem-rust epidemics never occur over large areas, such as a whole State, or even a large group of counties. However, in the upper Mississippi Valley stem-rust spores are carried considerable distances by strong winds enabling stem rust to develop rather wide-spread epidemics. In some cases severe rust spreads are very local, only a few square rods in area; in others it develops into epidemics covering many square miles. In most cases the smaller rust spreads can be traced directly to an infected barberry bush. In the wide-spread epidemic the source or sources can not be definitely located.

One badly infected barberry bush in a small irrigated area near Sidney, Montana, was the cause of a local epidemic covering nearly every grain field in that area. A number of plantings of barberry seem to be centers from which local epidemics occur in the southern part of South Dakota. Rust was found on oats in the central part of Minnesota and a field man traced it back for seven miles to a group of infected barberries. An area of escaped barberries near Trempeleau, Wisconsin, which has not yet been cleared of all seedlings and sprouts, appears to have been the cause in 1924 of stem rust on oats in an area extending more than 80 miles northward.

Reports from Ohio and Michigan indicate that all stem-rust epidemics occurring this year could be traced to infected barberries.

For many years two barberry bushes seem to have been the cause of losses from stem rust in the home neighborhood of the writer. The location of one bush and some escapes that had developed from it was found on the first survey. The second survey revealed the sprouting old crown of another bush which had been cut down some years before. The Indiana leader again reports infected barberries near the Ohio River spreading rust, as well as infected barberries across the river in Kentucky. In southern Iowa, near Redding, stem rust was traced on oats for at least two miles from an area of barberries. A number of cases were reported this year from Illinois, in which rust was traced from infected barberries to oats. In one county as many as five of these local rust spreads were mapped. Hundreds of instances have been observed during the barberry eradication survey in which stem rust has spread from common barberries to grains and grasses. Stem rust will not germinate unless the conditions of moisture and temperature are favorable. Heavy dews and fogs or hot weather after steady, quiet rains furnish the best conditions for spore germination and consequently for rust infection. Heavy, driving rains probably are not so favorable for infection, because they wash many of the spores from the plants on which they have fallen.

After the rust parasite has entered a plant it will develop most rapidly when the weather is rather hot and muggy. At low temperatures the rust develops much more slowly, and it also may be checked by hot, dry weather. When the right conditions occur at just the right time

epidemics develop. The variety of grain grown and the condition of the plants may affect the rapidity of the growth of the rust parasite.

HOW TO REDUCE STEM-RUST LOSSES

Stem rust probably can not be prevented entirely, but in some areas the losses which it causes can be so reduced that they will be negligible. Proper soil management, early sowing, the use of early-maturing and resistant varieties, the destruction of weed grasses which can be attacked by rust and, most important of all, the eradication of the common barberry will aid in reducing stem-rust losses.

In the more eastern States of the barberry-eradication area, where widespread epidemics were not of yearly occurrence the removal of the offending barberries has reduced the losses from stem rust to a minimum. It now appears certain that complete eradication of all rust-susceptible barberries from the upper Mississippi Valley will very materially reduce the losses resulting from stem rust.

THE COMMON BARBERRY

The common barberry (Berberis vulgaris L.) is harmful and should be destroyed. It has been used as an ornamental shrub, as single bushes, or in clumps or hedges. In earlier days the leaves of the common barberry were used for medicinal teas, the roots for dye material, and the berries for jelly. Its seeds have been spread by birds, animals, wind and water to woodlands, brushy pastures, rocky cliffs, stream banks, and fence rows until millions of escaped bushes have sprung up in localities where this bush has been planted. This shrub is tall and erect, usually 5 to 7 feet high but often attaining a height of 12 feet or more. As a

rule many stalks arise from a single crown. The bark is grayish and there are spines along the stem, usually in groups of three or more. There are green and purple varieties of common barberry. The leaves normally are produced in clusters and always have sharply bristle-toothed edges. The small, yellow flowers are inconspicuous, but the oblong red berries, which are produced in late summer and fall, are numerous and easily seen. They hang in drooping clusters like currants. The wood of of both shoots and roots is of a bright yellow color.

The Japanese barberry (Berberis thunbergii) is harmless and should not be destroyed. It is a low gracefully spreading bush with reddish bark, usually 2 or 3 and seldom more than 4 or 5 feet tall. The spines are smaller than those of the common barberry and usually are single, but sometimes in twos and threes. The leaves are small and have smooth edges. The flowers are yellow and the red berries are borne singly or in small clusters of 2 or 3, like gooseberries.

APPROPRIATIONS FOR BARBERRY ERADICATION

Some preliminary publicity was begun and an organization was effected in the spring of 1918 with a portion of the special appropriation for "Stimulating Agriculture". The first direct Federal appropriation of $150,000 became available July 1, 1918.

The annual appropriations for the following three fiscal years amounted to about $150,000. On July 1, 1922, the appropriation was increased to $350,000. For the fiscal year beginning July 1, 1923, an appropriation of $425,000 was made. Of this amount, $125,000 became available only when an equal amount was furnished by the cooperating State and

other agencies. This provision was met and the entire appropriation became available. The appropriation of $411,315 for the present fiscal year also required that $111,315 must be met by an equal fund raised by the States and cooperating agencies. This amount was certified and the entire appropriation became available July 1, 1924.

The total appropriations for the seven fiscal years, 1919 to 1925, inclusive, has amounted to $1,780,715, or an average of $254,387.85 a year. Funds and services equivalent to a total of $464,000, furnished by State and cooperating agencies, have helped to make the work more effective.

ORGANIZATION AND COOPERATION

The barberry-eradication campaign is carried on as a part of the Cereal-Disease Investigations of the Office of Cereal Investigations. An administrator and assistant with stenographic help are employed in Washington. Fiscal matters are handled with those of the Office of Cereal Investigations. A State headquarters is maintained in each State. In most States office space, heat, light, and other expenses incidental to these offices are furnished by the State Agricultural College or experiment station in the extension division, botany or plant pathology departments. In one State the office is housed with the State Department of Agriculture and in another in a post office building. A formal agreement of cooperation was signed with the extension divisions of the colleges of agriculture of these States in 1919.

A State leader is employed throughout the year in most of these States. Field assistants are employed during the eradication season from

July to October. Field assistants usually are selected from the agricultural college of the State concerned. Nearly all of the best scouts have had training in plant pathology, botany, and agronomy. In each State a school for field men is maintained for at least two weeks each season. All applicants for positions must attend. They are as thoroughly schooled as possible in that time. Difficult examinations on stem rust and its relation to the common barberry, methods of survey and eradication, of publicity, and of presenting the problems to property owners are given and the best men are chosen. A number of requirements in addition to ability to answer a definite set of questions are taken into consideration, namely, personality, ability to meet people, knowledge of automobile driving and ability to see and grasp a situation.

The field men are divided into squads of four or six each, depending upon the plans of the State leader and the territory to be covered. One man is designated as squad leader. He is responsible for the conduct of the field operations as directed by the State leader. He places window demonstrations, arranges for necessary chemicals for eradication and makes contacts with property owners, county agents, and others. Either Government-owned trucks or rented automobiles are used to transport field men, tools, and chemicals. Two men usually travel in each car taking turns at driving and keeping records. Both inspect properties and eradicate bushes. In States where there is a large field force the service of an assistant State leader very often is necessary at the peak of the field season. Usually a special publicity man is selected from the field men for placing and taking care of demonstrations at State and county fairs and similar meetings. He also writes publicity articles for local newspapers and

gives talks before farm and other organizations.

Field operations conducted with any special State funds are carried out either under the direction of the Federal State leader or in close cooperation with the Federal forces. In some States per diem of Federal field men is paid from State funds, while in others chemicals and labor for eradication, and means of transportation are furnished. In a few States definite areas are assigned to State forces and the eradication in those areas is conducted under State supervision. Plans are being made in some of the States to take over on State funds the resurvey and the eradication of bushes, sprouts and seedlings from areas of escapes. The Conference for the Prevention of Grain Rust, composed of representatives of commercial and agricultural interests, has furnished funds for chemicals and publicity.

PUBLICITY AND EDUCATION.

Publicity has been carried on in each State under the direction of the State leader or a specially trained assistant, in cooperation with the Conference for the Prevention of Grain Rust. Besides an attempt to spread barberry eradication publicity generally throughout each State, efforts have been made to familiarize every citizen of each county with the purpose of this campaign just previous to the survey in that county. After the survey in a county is completed the public is informed of the results.

Publicity through schools has been especially emphasized during 1924. The cooperation of Smith-Hughes vocational school instructors and city and county superintendents of schools has made it possible to train

many of the school children to identify the common barberry and the stages of stem rust. Sixteen sets of a lantern-slide series, "Kill the Common Barberry", and a number of prints of the motion picture films "The Barbarous Barberry" and "The Battle Against Black Stem Rust" have been circulated to teach the characteristics of the common barberry and the damage that it does by spreading stem rust to small-grain crops. Demonstrations and portable window displays have been used in all of the States to emphasize the necessity of removing barberries. Circular letters have been sent to at least half of the rural property owners in many of the States. Numerous newspaper articles have been published in each State. These show the purpose and summarized results of barberry eradication and tell especially of the removal of large bushes and hedges which have been shown to have caused severe local stem-rust losses.

The Conference for the Prevention of Grain Rust, has cooperated in every way to make the publicity campaign more effective. Over one million copies of the circular "Farmer Brown Beats the Rust" were distributed to the farmers of the grain-growing States. Special statements to business men, charts for use in schools, and window displays have been effectively distributed. During the past year the Conference has distributed thousands of samples of common barberry twigs for use in identifying the bush. The United States Department of Agriculture and the Conference for the Prevention of Grain Rust have distributed a total of approximately five million bulletins and circulars relating to the barberry eradication campaign.

State circulars and bulletins have received a very wide distribution within each of the States. The State leaders also have published reports and articles in cooperation with the State Experiment Stations, Extension Services, and allied Agricultural College departments.

SURVEYS

Original Survey

The original survey is the first complete survey of every city, village and rural property in a county. The thirteen States in the eradication area contain 976 counties. Original survey appears to be necessary in an area equivalent to about 900 counties. The original survey in cities and villages was largely completed in the first two years of the campaign. Rural survey was begun in 1919. In cities, survey was done on foot. Rural farm-to-farm survey made it necessary to procure other means of transportation so that every farm might be visited and the barberries economically found and eradicated. In order that tools and chemicals for eradication might be transported also, fifty-two light trucks were purchased for use where there was a long seasonal period of survey. Additional cars were rented during the summer months when weather conditions and available trained field men made it possible economically to increase the field force.

Since April, 1918, practically all city, village and rural properties in 786 counties have been covered by the original survey. The first survey has been completed in Indiana, Iowa, North Dakota, South Dakota, Wisconsin and Wyoming, and practically completed in Colorado, Minnesota and Nebraska. There still remain 59 counties to be surveyed in Illinois, 22 or more in Michigan, 30 in Ohio and 10 or more in Montana. In the original survey to December 31, 1924, a total of 6,358,343 common barberry bushes has been found on 68,465 properties. Of these 67,510 properties have been entirely cleared of 5,813,192 bushes. In addition 2,421,926 seedlings were found on this survey most of which were destroyed immediately.

Second Survey

Local stem-rust epidemics of 1922 and 1923 in counties which had been covered by the original survey, made it apparent that some barberries had been missed. Especially did the necessity of a second survey become apparent during 1923 when many local stem-rust epidemics were traced directly to remaining barberry bushes. With information gained in the original survey, the methods of farm-to-farm survey during 1923 and 1924 have been made more efficient to prevent, as far as possible, any bushes being missed. On second survey it is planned to get every bush previously missed. One of the problems of second survey has been the escaped bushes and seedlings not found on the original survey or developed after it was conducted. The problem of new crops of seedlings must be met continually on second survey and resurveys.

If maps of areas of escaped bushes have been made they must be checked on second survey to make sure the outer boundaries of the area are included. If there are no maps they must be made. By this means the expense of subsequent resurveys is reduced to a minimum and little or no stem-rust inoculum is allowed to spread from these barberries to the small-grain crop. On the basis of numbers of original bushes found in the second survey so far accomplished, the original survey was about 92 per cent efficient. Many of the bushes found on second survey are bushes that were cut down but not killed by property owners in the beginning of the campaign. The locations of these cut bushes were not reported and the field men often were unable to find them in the original survey. Sprouts appeared later and the bush again spread stem-rust inoculum. As these bushes were located in the second survey for the first time by

federal or State field men these locations are recorded as original locations.

From the beginning of the second survey in 1922, to December 31, 1924, an area equivalent to over 111 counties has been covered by a second complete survey. A total of 10,106 original bushes was found on 1,003 properties. Of these, 10,086 bushes have been destroyed. Seedlings numbering 9,579 were found on 54 of these properties and all were destroyed.

The data on properties, bushes and seedlings for the second survey are new and are included in the data for the original survey as the bushes and seedlings found on second survey have not been found or recorded previously.

Data for 72 counties covered in the second survey were compared with those from the original survey of these same counties.

The comparative figures obtained in these 72 counties, were as follows: On the first survey 170,461 barberry bushes and no seedlings were reported as found on 4,896 properties. Of these 70,780 were escaped from cultivation.

In second survey 14,721 original bushes and 26,879 seedlings were reported found on 879 properties. Taking the bushes as a basis, 93 per cent of the total were found on original survey and 9 per cent on second survey and resurveys. Taking the properties as the basis, about 82 per cent of the infected properties were found on original survey, and about 18 per cent on second survey and resurveys. On the first survey no seedlings were found, at least, none were recorded, while 26,879 of these potential rust-spreaders turned up in second survey and resurveys. Figures for cost of first survey have not been segregated for every one of

these 72 counties. The cost of the original survey in 54 counties totals $47,470, or an average of $879 per county. The total cost of the second survey of these same counties was $60,387.98, an average of $1,118 per county. This indicates that the second survey is being made more carefully than the first.

A second survey has been proved to be necessary. With the knowledge as to where missed bushes and developing seedlings may exist, this second survey and all original survey yet to be done can be accomplished much more efficiently than was the early original survey. Seedlings not yet developed can not be found until they are large enough to be seen, but the probable locations in which they may be expected are being mapped.

On second survey, all maps already made of farm locations and of areas of escaped bushes are checked so that the exact location of bushes and hedges is carefully shown. Maps of areas of escapes are checked to make sure that they take in all territory that should be visited on re-surveys. If any areas of escapes were not mapped when found in the first survey, maps are prepared.

These precautions are necessary in order that all seedlings and sprouting bushes may be found and that subsequent surveys may be easily and efficiently carried out by men not familiar with the original locations.

In each of these 72 counties an average of 68 infected properties was found the first time. Subsequent second survey discovered an average of 12 missed plantings per county. These were 12 potential rust centers. In many cases one rust center is enough to cause a county-wide epidemic if conditions are right. Even one overlooked bush per county is dangerous. If only two plantings existed originally it shows only 50 per cent effi-

ciency. To miss one bush in a county may not seem to be serious but it may mean the loss of thousands of dollars to nearby grain growers.

Resurvey

Barberry bushes, if fragments of roots are left, usually sprout the year following digging and within two years after chemical treatment, where the chemicals have not destroyed all stems and roots. This necessitates a revisit to every property upon which barberries have been previously found. Resurveys follow the original survey after an interval of at least two growing seasons, thus allowing time for any living roots to sprout and for scattered seeds to germinate.

Even a single seedling left in a favorable location may within ten years become the center of a large area of escaped barberries counteracting the efforts of eradication in that locality. A few sprouts or seedlings in one area even may cause a rather widespread epidemic, especially if there are many grain fields near by. In many instances several successive resurveys are necessary.

During the second surveys of 1923 and 1924 it was necessary to resurvey a large number of properties on which barberries had been previously located in many of the counties. Combining these two activities in this way practically eliminates the expense of one resurvey. As a rule, therefore, resurvey will be combined with the second survey in those counties where a second survey is necessary.

Areas of Escaped Bushes

For areas of escaped bushes a map is prepared showing the extent of the area, the land marks, and the relative position of bushes with reference to land marks. All bushes are then treated with salt or kerosene,

as conditions warrant. Bushes near valuable trees are dug. Seedlings are dug or pulled. The strip method of survey and eradication is used in most cases. No attempt is made in the larger areas of escapes to eradicate all seedlings the first year. In smaller areas or under conditions where it seems possible to prevent local outbreaks of rust by so doing an attempt is made to get every seedling the first time over the area. However, small seedlings usually are left for subsequent resurveys. One reason for this is that the mortality of one-year seedlings is great. Another is that many seeds germinate the first season after the shade of the old bushes is removed and wherever the earth is disturbed about the bushes. Many seedlings appear near chemically treated bushes but the mortality is high in the first year. Chemical treatment has little or no effect upon seed germination. Seedlings with new seed leaves have been found in areas of escapes six years after old fruiting bushes were destroyed. Therefore, many resurveys of these areas are necessary.

ERADICATION

Until the fall of 1922 barberry bushes were either dug by hand or pulled with horses and tractors, and seedlings were pulled by hand or dug. The development of numerous sprouts indicated that pulling and digging were not effective methods of eradication in a majority of instances. Although digging is very effective in a loose sandy soil, it is almost impossible to remove barberries which are growing in rocky soil, near tree roots, or in rock crevices, without leaving some roots. As even small portions of roots may sprout every remaining root fragment is a potential rust producer.

To increase the efficiency of eradication, experiments with chemicals were begun in the fall of 1921. Of over forty chemicals used experimentally, only crushed rock salt and kerosene are recommended, as they are effective, cheap, and easy to obtain and apply. Sodium arsenite was used for several months during 1923, but its use was discontinued because of the danger of poisoning livestock.

Salt is easily applied and can be conveniently transported in the government-owned trucks. For an average-sized bush with a 12-inch crown, 10 pounds of salt is sufficient. The amount may be increased or decreased according to the size of the bush. There is very little danger to livestock in the use of salt if the animals are not allowed to eat too freely of it. Poultry are very likely to be killed by eating salt. To prevent this it is advisable to cover the base of all treated bushes with dirt. Kerosene is very effective. A bush with a crown about 12 inches in diameter will require one gallon of kerosene. Two quarts is sufficient for a 6-inch crown, and a small shoot will not need more than a pint. The disadvantages of its use are that the treated bushes do not die immediately following treatment, and it is hard to tell which ones of a group of bushes have been treated. It is not advisable to use kerosene when the bushes are rusted and should be killed immediately, as infected bushes can spread inoculum for a time after kerosene treatments.

In all, 796.47 tons of salt, 1,056 gallons of sodium arsenite solution, 15,011 gallons of kerosene, 10 gallons of drip oil, and a small quantity of carbon bisulphide have been used in destroying bushes, sprouting bushes, and seedlings.

INVESTIGATIONS

Ecological Investigations

The relation of environment to the distribution of barberry bushes has been studied in the 13 States of the barberry eradication area, and in the New England States, New York, New Jersey and Pennsylvania. Particular attention has been given to areas of escaped barberries throughout these States. Colorimetric analyses of soils were made and data compiled on the several floristic and ecologic factors which characterize areas of escaped barberry bushes. The size and vigor of the bushes in the States bordering the Great Lakes and in northeastern Iowa indicate that the common barberry has reached its greatest development in those areas. The two chief factors limiting growth seem to be soil reaction and moisture. In the Great Plains portion of the eradication area the bushes do not attain the height of those in the Great Lakes region, as the climate is too dry. Observations indicate that while barberries are tolerant to acid soil conditions, escaped and native barberries are usually distributed on limestone or neutral soils.

Study of Barberry Species and Hybrids

A Berberis garden has been established near Bell, Maryland, in cooperation with the Office of Horticultural Investigations, wherein all known foreign and native species and hybrids of Berberis are being assembled for description and classification. A sufficient number are being propagated so that the susceptibility of all of these species and hybrids can be determined at St. Paul, Minnesota, under controlled conditions. The literature has been searched, herbarium material examined, field observations made and greenhouse specimens studied for evidence of the

susceptibility of various species. Some of these data have been summarized. Having once determined the susceptibility or immunity of all species and hybrids of Berberis, these important data can be used in regulating their transportation and sale. Native species of barberry also are being studied in their natural habitat and effective methods of eradication of susceptible species determined. A species which appears to be Berberis canadensis Miller was found in 1923 along the Tippecanoe River in Carroll, White and Pulaski counties, Indiana. In 1924 a small area was found along Wild Cat River in Tippecanoe County, Indiana, and another area along the banks of Spring Lake near the Illinois River in Tazewell County, Illinois. Previously this species was not known to occur in the eradication area. Its occurrence had been reported in the Appalachian region of Virginia, West Virginia, the Carolinas and Georgia and in the Ozarks of Missouri. Berberis canadensis Miller is naturally susceptible and spreads stem rust to grains and grasses. In certain localities it is a great menace to small-grain growing and should be eradicated. Limited experiments show that bushes of this species may be eradicated by the application of salt or kerosene.

Effect of Chemicals on the Soil

Chemical studies and observations have been made of the soil-sterilizing effects of salt, kerosene, and sodium arsenite used in killing barberries. In the treatment of barberries either 10 pounds of salt or a gallon of kerosene, applied to about one square foot of soil area will kill all surface vegetation. On fairly level land the sterile area ordinarily will not be larger than the area treated, or that previously occupied by the barberry. In the north-central part of the United States,

where the annual rainfall is 30 inches or more, the ground will be more or less covered by vegetation during the second summer after salt treatment and, by the third year, little difference between treated and untreated ground can be noticed. As a result of irrigation or cultivation, the time during which the ground remains sterile is shortened. In the more arid parts of the country sterility lasts longer. The soil will not remain sterile quite as long after a kerosene treatment as after salt. Soil treated with sodium arsenite shows rapid leaching where rainfall is abundant.

Relation of Seasonal Storage of Reserve Food to Successful Eradication

Investigations of the seasonal change of the storage products of barberries have been in progress since September, 1922. This work has been completed and a manuscript is being prepared for publication. The substances studied are sugar, starch, hemicellulose, nitrogen, ether extract, moisture and ash. The chemicals used in killing barberries are effective at practically any season of the year and there is no apparent correlation between the amount of the storage products present and the rapidity of killing the bush. There may be a relation between the storage products present and the success of digging. Additional investigations are in progress upon the effect of cutting off all stems of a barberry and keeping the crown in darkness and upon the action of salt in killing barberry bushes.

Stem-Rust Investigations

The barberry eradication field forces carry out a portion of the stem-rust studies in cooperation with epidemiology forces of the stem-rust project of the Office of Cereal Investigations. This work is con-

ducted in the 13 eradication States and in other principal grain-growing States from the field headquarters at St. Paul, Minnesota. Special epidemiology field men cooperate with the State leaders and their assistants. These investigations include (1) overwintering studies, (2) the finding, tracing and mapping of local or more wide-spread epidemics and the determining of possible sources of inoculum, (3) the relation of weather conditions to the spread of rust, and (4) estimates of severity of epidemics and the losses produced.

REGULATORY WORK

In North Dakota a barberry-eradication law was passed in 1917; others of the 13 States either found that existing laws covered the situation or asked amendments to old laws or passed new laws. State quarantines prohibiting the sale and shipment of susceptible barberries have been placed where necessary. A Federal quarantine prohibiting the shipment of a number of species of susceptible barberries into the 13 States of the eradication area was placed, effective May 1, 1919.

In most instances property owners have cooperated so closely in the destruction of their common barberry bushes that resort to the courts rarely has been necessary. Laws are necessary, however, and the fact that they exist has caused many property owners to remove their bushes. Law enforcement where necessary usually has been carried out promptly by the State law-enforcement agency. State leaders keep in close touch with them and report cases where property owners refuse to remove bushes. In some States these agencies are aiding in the campaign by doing survey and eradication under State appropriations. In others they take no part in the campaign unless removal orders are necessary.

It is remarkable that in a campaign covering 13 States and eradicating over 10,600,000 bushes, sprouting bushes, and seedlings from over 67,000 properties, less than an average of one case to a State should reach the courts. In many cases property owners have spent much money in the destruction of bushes and in relandscaping a valuable property, while in other cases there has been a real sacrifice of time and labor in just being a good citizen.

CHECKING METHODS USED TO ASSURE EFFECTIVE RESULTS

A number of methods of checking to make sure that the greater number of bushes have been found are used.

1. The principal one is the checking of areas by State and sectional leaders in charge. This has been done in various ways. Usually either small areas are checked in each county for efficiency, or a careful search for missed bushes is made by the squad leader in the county as the work is being supervised. The first method is varied by allowing one squad of field men to check a small portion of the area surveyed by another squad in an adjacent township or county.

2. Property owners, county agents, county and State officials, and farmers are asked to look for missed bushes and report their location.

3. All reports of local outbreaks of stem rust are followed up by survey to find, if possible, the rust-spreading barberries. In the eastern States of the group barberries usually are found if rust is severe. In the western group barberries sometimes are found, sometimes not. In this section wind carries spores greater distances.

4. Simultaneous surveys for stem rust sometimes are made in every part of a selected county within a limited number of days. The severity of the rust is mapped and the most severely rusted areas resurveyed for barberries.

5. The placing of decoy bushes in areas where but few bushes occur keeps up the interest of the field men so that they make a careful survey of each property. In areas where bushes are rather plentiful the leaders usually know the exact location of a number of plants. The field men are not advised of the existence of these plantings and a close check-up is made to determine whether or not the field men find and eradicate them.

6. While all of these methods proved good and are used, a second complete survey of a number of counties is being made as a real test of efficiency.

SUMMARY OF RESULTS FOR SEVEN YEARS

In the seven years of the campaign, from April 1, 1918, to December 31, 1924, the equivalent of approximately 786 counties has been covered in the original farm-to-farm survey. The original survey of practically all cities in the entire 13 States has been completed. Of the counties already covered by the original survey approximately 111 have been surveyed a second time. In continuing the resurvey it has been necessary to revisit, one or more times, the properties from which barberries were eradicated to make sure that no sprouts and seedlings remain, in approximately all counties covered by the original survey.

Original bushes numbering 6,358,343 have been located on 68,465 properties. Of these, 5,813,192 bushes have been destroyed on 67,510

properties. In resurvey, 273,619 sprouting bushes were found on 10,925 properties and 272,593 sprouting bushes were destroyed from 10,902 properties. In all surveys, 4,607,142 seedlings were found and 4,548,956 were destroyed. These totals include 10,106 bushes and 9,579 seedlings found and 10,086 bushes and 9,579 seedlings destroyed on second survey. This makes a grand total of 11,239,104 bushes, sprouting bushes and seedlings found and 10,634;741 bushes, sprouting bushes and seedlings destroyed in all surveys during the entire campaign.

The ultimate success of the campaign depends, however, upon educating everyone to recognize that in the northern part of the United States successful grain growing can not be expected where barberries exist. Each barberry bush must be considered a real menace to our grain crops and its eradication must be demanded for the good of the whole people. In order to carry the message of barberry eradication to the citizens of the grain-growing areas of the United States the cooperation of all federal, State and local agricultural agencies, commercial and educational organizations, and institutions is necessary.

After all the barberries are eradicated from the eradication area a continual vigilance will be necessary to keep it free of this stem-rust spreading pest.

PAPERS ON PLANT PATHOLOGY

WITH SPECIAL REFERENCE TO FOREST PATHOLOGY.

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OUTLINE OF WORK OF OFFICE OF PLANT DISEASE SURVEY AND PATHOLOGICAL COLLECTIONS

By Dr. C.L. Shear
In Charge of the Above Office.

The activities of this Office are devoted to the gathering and supplying of as full information as possible concerning the occurrence and distribution of plant diseases and parasitic fungi and to rendering all assistance possible to pathologists, horticulturists and investigators interested in plant pathology and plant culture. The work of the Office is devoted to two projects, the Plant Disease Survey and Pathological Collections.

The Plant Disease Survey Project covers the collection, recording and reporting of all available data regarding the occurrence and distribution of the plant diseases of the United States. It also studies epidemics and unusual outbreaks of disease and distributes this information to Department and State pathologists and others interested. Through the cooperation of its collaborators in each State it carries on a continual search for new or dangerous diseases which may be introduced in the United States in order that necessary measures for their control or eradication may be promptly taken. It cooperates with all the offices of the Bureau and Department who are carrying on pathological work or are in need of the information secured, and also with all the State pathological workers in assisting the field surveys and securing information regarding the pathological problems. It publishes reports and summaries of the data collected regarding the occurrence, distribution and severity of the diseases of all important crops each year. It is now preparing a check list of all the plant diseases occurring in the United States and collecting

material illustrating these diseases.

The Pathological Collections project is devoted to the collection, preparation and preservation of specimens of fungi and other parasitic plants which cause or are associated with plant disease for study, reference and exhibition. These collections are catalogued, carefully preserved and made available for examination and study by the investigators of the Department of Agriculture, the States, and any other mycologists or pathologists who may desire to use them. The work also includes the preparation of indices for use in connection with investigations of pathological and mycological problems. One of the chief duties of the Office is to study and identify parasitic and other fungi which may be submitted by the various pathologists in the Department of Agriculture and in the colleges and experiment stations, and to supply any available information in regard to the occurrence, distribution and literature relating to these subjects. The Pathological Collections now contain over 150,000 specimens and large additions are being made annually.

In connection with these projects it is desired that all field workers connected with the Department of Agriculture or Experiment Stations, or educational institutions, collect and forward to us any interesting specimens that they may find of plant diseases or fungi; as there are many of our native parasites which probably have not yet been collected, and many others whose distribution and prevalence in the United States are little known. The Office is primarily a service organization for the pathological workers of the Department and the States. It does not carry on purely pathological investigations of specific problems or attempt to experiment with control measures except in the case of diseases of cultivated mushrooms.

EXTENSION WORK IN PLANT PATHOLOGY.

By F. C. Meier

Extension Plant Pathologist, U. S. Department of Agriculture.

Although some extension work in Plant Pathology is carried on in practically all states, 19 are maintaining approved Smith-Lever projects dealing with this subject. Thirty extension pathologists, some of them working as part-time extension men, carry on the work in these states. These men, cooperating with the State and Federal entomologists, horticulturists and agronomists, help to form a group of specialists, which serves as an auxiliary and directing force to the county-agent system.

In Washington, the Extension Pathologist acts as a liaison officer between the office of Cooperative Extension Work and the several pathological offices of the Bureau of Plant Industry. There are many interesting phases to this work. Perhaps some of the most important of the activities carried on in this office are connected with what might be called service work. For the use of the extension men working in the states, an effort is being made to build up a collection of slides, charts, and motion pictures for the purpose of supplementing department bulletins on crop diseases. The office is also a sort of clearing house for information on methods of conducting Extension Work in Plant Pathology.

The matter of lantern slide service may be of particular interest for the reason that the Blister-Rust agent may occasionally be able to use some of this material as a part of the general plan on which the Visual Instruction and Editorial Section, Office of Cooperative Extension is working. It is our aim to prepare sets of colored lantern slides, illustrating

the diseases of certain crops. These slides are numbered and arranged to illustrate a mimeographed syllabus, which covers the subject. The syllabus is usually written by the research worker who is best equipped to handle the particular subject involved. Usually he is the man who would write a department bulletin on the subject. Six to ten copies of each set are prepared, and, with the syllabus, are available to field workers as a loan.

Closely related to this work is that connected with the preparation of charts. When arrangements were made for me to speak to this group this morning, I was asked to discuss the chart series prepared by the Office of Cotton and Truck Crop Diseases. This series of charts was started in 1918 by Dr. M. F. Barrus, who at that time was in charge of extension work in truck crop diseases for the Department. Dr. W. W. Gilbert assisted Dr. Barrus in the preparation of this material, and, after Dr. Barrus left the Department in 1919, continued the work. We now have available for use by extension workers charts on 30 subjects. Two to seven copies of each have been made and these are issued as loans. These 30x40 hand-colored bromides are somewhat different from the usual thing in the way of charts. Instead of giving much space to diagrammatic presentation of fungous morphology, an effort has been made to prepare illustrations which will enable the farmer to identify a given trouble. In most cases material was selected for photographing in as nearly as possible the condition that it would be found in the field. A few exceptions are charts made to illustrate diseases as they are seen on the markets. Here again the same principle was followed, that of preparing an illustration which would enable the group where the chart is to be used to recognize the diseased plant product.

Plans are now being made to add to the list of available subjects by preparing charts on cereal, fruit and forest tree diseases.

It has been noticed, when reading the Blister-Rust News, that this group has made much progress in utilizing extension methods in handling their field work. The extension pathologists are also interested in the philosophy of extension teaching. Working as a member of Mr. Graham's staff in the Division of Subject-Matter Specialists, Office of Cooperative Extension Work, the Federal Extension Pathologist attempts to collect information on best methods of conducting field work. This information is then made available to the extension pathologists in the states. One of the best ways in which we have been able to accomplish this is by publication of our monthly news sheet, THE EXTENSION PATHOLOGIST. In this mimeographed paper the Extension Pathologists and others who are interested have an opportunity to discuss methods by which they have successfully conducted field work.

The opportunities for work in this field were never so great as at present. Increased cost of labor and other items connected with production, the practice of selling many plant products, according to grades, which are based in part on degree of freedom from disease, and the prevailing high freight rates make desirable the efficient production of high-grade products that can be transported without excessive wastage. In general, application of disease control measures is one of the necessary steps by which this result can be obtained.

CERTAIN RESEARCH ACTIVITIES OF THE OFFICE OF FOREST PATHOLOGY

By Dr. Haven Metcalf
In Charge Office of Forest Pathology
Bureau of Plant Industry, U. S. Dept. of Agriculture.

For reasons of local geography, we placed Mr. Hahn's demonstration first on the program. It makes a suitable introduction as it concerns western as well as eastern work and pinon blister rust as well as the white pine blister rust. His method differentiates the two rusts in the uredo stage. We still have need of learning how to differentiate them in the telial stage. It is possible that some method may be found based on a biometric study of some of the elements of this stage.

We have reached a stage of investigative study on the white pine blister rust where the center of gravity is shifting from the East to the West. In a disease of this kind it is necessary to repeat experiments in different localities in order that we may not be deceived by conditions which are largely or partly local. We would expect an introduced parasite to be locally variable. It is moreover doubtful whether any further research work that can be undertaken on the life history or morphology or physiology of Cronartium ribicola will change or materially improve the method you are now using for its control. These control methods have now been in actual practice long enough to demonstrate their quality on a basis of experience. It is no longer necessary nor desirable to draw inferences as to methods of control from the life history of the fungus. This furnishes an additional reason for shifting the center of gravity of our research to the West, where much remains to be determined regarding methods of control. There nearly all of our experiments done in the East should now be repeated.

It is probable that Doctor Spaulding will shortly become a near neighbor to most of you, as it is expected that he will be appointed Pathologist at the Forest Experiment Station at Amherst, Mass., effective July 1. He will continue there to be available for consultation and for emergency work in connection with the white pine blister rust, but the bulk of his official work will concern other diseases. Dr. Spaulding will shortly address you on the subject of his studies of sporidia. The situation regarding the research on sporidia illustrates several of the points I have mentioned above. Doctor York, working exclusively at North Conway, N. H., and doing a comparatively limited amount of work, determined that the limit of viability of a sporidium is 10 minutes. There is no question that his results were accurate, but his observations were too limited to generalize from permanently and extensively, and accordingly we have repeated his experiments, working in different localities and of course in different years. Dr. Spaulding will tell you how these experiments have materially extended the viability period, and the differences form an additional reason for making the next sporidum study in the West. If we had secured these results five years ago, it might have shaken our faith in the validity of the 300-yard limit, but the validity of this limit now rests upon experience so far as the East is concerned.

I wish that we knew that the blister rust was the last of our troubles, but I fear that it is only the beginning. A multitude of foreign diseases remain to be introduced into the United States, and some of them are bound to find their way in. Regarding one of these, the Douglas fir canker of Great Britain, I wish to speak a few words, since all of you may be able to make a contribution to the study of this subject. The

Douglas fir canker is, as you see by specimens, a canker disease of dangerous type and has caused some concern in Great Britain where the Douglas fir is being planted extensively in the course of reforestation. The disease has not yet been found in this country, but if it is not here it is an accident. Miss Anna E. Gott, working over the records of the U.S. Customs Houses for this Office, has found that over 5,000 Douglas fir trees (nursery stock of course) have been introduced into this country from potentially dangerous localities in England, that is localities known defintely to harbor the disease. Most of these trees appear to have been distributed in New York and New England, and I am therefore interested in getting any information on the present condition of planted Douglas fir. I show you here a somewhat poor specimen of Douglas fir, together with specimens of the peculiar and very characteristic cones. You can do a great service if you will familiarize yourselves with this tree and examine planted Douglas fir wherever you find it, looking carefully for any disease and sending me specimens of any disease that you find. You may in this way become the discoverer of Douglas fir canker in America. As you know, the Douglas fir is the most important timber tree remaining in America, and the introduction of a dangerous parasite of it would be a calamity that would make the chestnut blight and the white pine blister rust look inconspicuous.

METHODS OF IDENTIFYING BLISTER RUST BY INOCULATING RIBES IN THE GREENHOUSE.

By Glenn Gardner Hahn
Office of Forest Pathology, U.S. Bureau of Plant Industry.

Two Blister Rusts, the Piñon Blister Rust, Cronartium occidentale occurring on the Piñon or nut pines of the West, and the White Pine Blister Rust, Cronartium ribicola, both infect Ribes, and where they occur in nature on gooseberries and currants, they can not be told apart in the uredinial stage, macroscopically, that is, with the naked eye. This condition makes the position of the field man scouting for advance infections of the White Pine Blister Rust in the Pacific Northwest in the states of Washington, Oregon and California,- Idaho, Nevada, Wyoming and Utah very difficult in determining whether he is dealing with the White Pine Blister Rust on Ribes or the very similar Piñon-tree Rust on the same host.

Certain microscopical differences exist between these two species of rusts, in their uredinial stages, but these are so slight as to require further differential evidence. The problem has therefore been undertaken to further separate the two species on a physiological basis wherein their respective reactions on the same species and varieties of Ribes would be ascertained and tabulated. Accordingly a large number of species and varieties of Ribes and Grossularia have been tested out with the two Blister Rusts under similar conditions of inoculation in the Pathological Greenhouse, Washington, D. C. The plants which have been widely gathered for this problem, include native species from all parts of the United States and from Canada, and a large collection of cultivated varieties.

It has been found as a result of these investigations that certain species of Ribes and Grossularia are susceptible to the White Pine Blister Rust and resistant or immune to the Piñon Blister Rust. In no case was the reverse found to be true. A number of varieties of Ribes vulgare, the common red garden currant, have shown themselves constant hosts in being susceptible to the White Pine Blister Rust and resistant to the Piñon Blister Rust. Among the above, the widely grown variety, Fay's Prolific, and the common white variety, White Grape, have proven to be both excellent varieties for this differential inoculation test.

Any "unknown" uredinial infection from the West can thus be readily determined as to its identity by the above methods indicated and which have been devised as a result of this investigation. These results, which will be published shortly, supplement microscopical differences to be found in the laboratory. Together these tests in the greenhouse and laboratory will identify the unknown rust in question to a high degree of certainty.

LONGEVITY OF BLISTER RUST, TELIOSPORES AND SPORIDIA

By
Dr. Perley Spaulding
Pathologist, Office of Forest Pathology,
U. S. Department of Agriculture.

Telia:

The season of their production commonly is from early in July until winter. Our experiments and experience in the field show that some of the first ones formed may survive and form sporidia even in early winter (Dec. 3). There is comparatively little waste with the telia---rather few, we believe, fail at some time to form sporidia. Wet weather, regardless of the temperature, will cause them to germinate. From six to twenty hours of continued dampness is needed for this, depending upon their age and vigor. Telia upon fallen leaves may live as long as those hanging upon the bushes. They germinate with a germ tube which forms a four-celled promycelium; each cell of this germinates with a short tube which forms a tiny, round sporidium.

Sporidia:

The sporidia just before maturing has a tiny droplet of water at its base. When mature the sporidium is shot off forcibly---and the droplet of water with it! The actual distance they are shot off is of course small--as they are not larger than some bacteria---but it is sufficient so that the wind can carry them off readily and they are so small and light that currents of air imperceptible to us easily carry them off. They are smaller and lighter than certain pollen grains that are definitely known to have been blown hundreds of miles; dust, which is much heavier, has been known to be blown from the Sahara region in Africa to

central Europe, a distance of about 1500 miles. There is no reason to suppose that the sporidia travel any less distances---but how long they may survive under those conditions is absolutely unknown---and probably will remain so for a long time.

The sporidia retain viability in damp air for relatively long periods of time---damp air does not mean that there is perceptible visible fog or mist---it means that there is a certain amount of water vapor which is invisible to us except that we might say that the air feels damp to us. Such dampness is present in the air of the northern states during any prolonged cloudy weather; sunny weather dries out this water vapor to a point where the sporidia are soon killed. We got fair germination from sporidia which were exposed 26 hours in rather damp air---relative humidity of over 70 per cent and temperature of 58-62. Nearly all of the species of Ribes have given longevity up to the extreme time that they have been tested. R. nigrum is not necessarily in a class by itself. Drying reduces their viability. Alternate drying and wetting is not as deadly as supposed; a fair percentage survived four and five re-dryings, and a few survived as many as eleven dryings. Under certain circumstances they may germinate and form secondary sporidia. This suggests that when conditions were not favorable for infection to take place by the first set, they might germinate and get far enough so as to form secondary sporidia, which in turn might survive quite a while after the first set had reached their limit of viability. In this way their period of infection may be extended beyond that to be commonly expected.

NOTES ON OTHER MATTERS PERTAINING TO THE OFFICE OF FOREST PATHOLOGY

By
Dr. Perley Spaulding,
Office of Forest Pathology

Specimens:

The Office of Forest Pathology would be very glad to receive specimens at any time of Cronartium comptoniae and of Cronartium ribicola from as many different hosts as possible and from different localities. These specimens which are kept in the files of the Office may be of historical value and always have reference value.

Exotic Pines:

Notes on the occurrence of exotic species of pines may be of much value, especially those concerning collections of several species in a single place, as in a private arboretum, pinetum or plantation. This Office would be pleased to receive such notes from the men engaged in blister rust control.

Historic Specimens of Blister Rust were shown including a series of specimens, the first found in each state: Me., N.H., Mass., Conn., Vt., N.Y., Pa., N.J., Va., Ohio, Ontario, Wisc., Wash., B. C. A series of specimens on Pinus albicaulis, ayacahuite, balfouriana, cembra sibirica, excelsa, flexilis, koraiensis, lambertiana, monticola, strobus.

Publications:

Types in which blister rust articles have been published were exhibited including legal statutes, G.O.P. campaign handbook, almanac, Sunday newspaper supplement, local newspaper, magazine, modern novel, general scientific journal such as Science and Nature, general natural history journals such as The Glasgow Naturalist, Bulletin of the Green Section of

the U. S. Golf Association, the journal Ecology, organ of a state civil service association, organ of a conservation commission, gardening journals both foreign and American, report of state department of farms and markets, miscellaneous publication of international institute of agriculture, report of state department of agriculture, monthly and weekly periodicals on agriculture popular and technical, circulars bulletins and report of state entomologists, state botanists and patholcgists, catalogues of forest tree nurseries, catalogues of seedsmen, journal of arboricultural society, report of public domain commission, report of provincial land department, report of state forester, report of state forest commissioner, special report upon forest conservation, forestry journal, monthly and weekly forestry and lumber periodicals, report of conference or meeting on blister rust, Blister Rust News, botanical journal, pathological journal, farmers bulletin, technical bulletin, forest school annuals, etc.

A collection of other publications was also shown including

1. Early American blister rust publications.
2. Earliest foreign publications upon blister rust.
3. Precedent breaking publications upon blister rust. (American)
4. Publications of the Office of Investigations in Forest Pathology upon blister rust.
5. Monographs of the forest tree rusts. (American and foreign) and,
6. Important earlier works upon forest tree diseases including the rusts.

Laboratory Exhibit

In the Laboratory of Forest Pathology permanent slides were shown of the following stages of the fungus: mycelium in bark, pycnospore bed in bark, Peridermium blister in bark, uredospore bed in cross section of leaf of Ribes, telial column in section of Ribes leaf, longitudinal section of a mature column to show the separate cells (teliospores), and newly germinated teliospores showing germtubes, promycelia, sporidia and germinating sporidia with secondary sporidia in a few cases.

Also Colley's apparatus for measuring spores with a millimeter rule was shown in action.

STATUS OF THE CHESTNUT BLIGHT

By George Flippo Gravatt
Office of Forest Pathology, U.S. Bureau of Plant Industry.

The cause, symptons, and history of chestnut blight are familiar to all of you. You also probably realize what a potent factor the chestnut blight has been in forwarding the blister rust work. When you speak of the possible and probable losses which white pine blister rust will cause in the next ten years, as a rule you have comparatively small visible losses in the immediate vicinity which the rust has already caused. As a matter of fact, though, you are projecting the probable loss from blister rust against a back-ground of the more or less complete destruction of chestnut in New England which this other exotic fungus has wrought in less than a quarter of a century.

This fiscal year the Office of Forest Pathology has a small appropriation for chestnut blight and for several months during the past field season four inspectors made a general survey of the Southern Appalachians. They estimated the amount of infection along highways and railways, spending less than a day to a county. This map shows the results of this survey, modified somewhat by estimates from cooperating state authorities and members of the Forest Service. The large spot infection in Georgia is on the southern edge of the zone of commercial chestnut. The center of the large spot infection in South Carolina is very interesting because the disease on nearly all of the trees has reached the same stage of development, which is quite different from the conditions in the average spot infection. A severe hail storm of May 1921 wounded the trees, giving the fungus places for entrance and result-

ing in extraordinarily rapid and uniform development. The hail injuries are still apparent on both chestnut and apple trees. How these spot infections started no one knows. Possibly migratory birds carried the spores or possibly they came from infected nursery trees. Two spot infections eradicated some years ago in Alabama were due to shipments of infected nursery stock.

The finding of this large spot infection in Georgia and Tennessee materially changed the forecasts on the spread of the blight in the South. From 1913 to 1923 the blight swept across Virginia at an average rate of about 24 miles per year. Last winter forecasts were published to the effect that the spread across North Carolina and southward would not be at a rate slower than this. I am sorry to say that the rate of spread will be even faster than predicted. When last year's data are completely correlated new forecasts will be made.

In the North it is known that the blight has covered practically the whole of the range of commercial chestnut, but exact evidence about the per cents of trees killed in different sections is lacking. This office has given very little recent attention to the chestnut blight there because the need elsewhere was so much greater. Markets are much better in the North and strong state forestry departments are handling the situation. Through Mr. Detwiler's cooperation a letter has been sent to each of the blister rust agents asking for their general estimates by counties on the per cent of lightly infected chestnut, percent half dead from the blight and per cent entirely killed by the disease. A tree which is dead except for sprouts from the root collar is considered as dead. Estimates will also be secured from state agencies and other sources, and all data

from these various parties will be combined in a map showing the present status in the North.

Various factors such as glutted local markets, lack of labor and sawmills and absentee ownership have prevented many owners from utilizing their killed trees before deterioration caused a great decrease in value. This general deterioration loss in different parts of the country is estimated as ranging from 10 to 40 per cent of the value of the standing chestnut timber. We are facing an even heavier loss on over thirty million acres in the Southern Appalachians having a general average of approximately 50 per cent chestnut, including extract wood.

The prevention of as much as possible of this severe loss of chestnut timber is an important matter. The part of the Office of Forest Pathology in this work is the determination of the present distribution of the disease, making forecasts on its rate of spread, and determining the rate of fungus deterioration of killed trees. State and extension foresters, pathologists and county agents have the results of our survey and forecasts on rate of spread will follow. A detailed study of the rate of deterioration in the South will be started shortly though as a present working basis for extension work our preliminary observations indicate that in general the rate of deterioration will be very similar to that in the North. The following two factors are considered of major importance in decreasing this probable loss of chestnut timber: First, an increase in the use of chestnut lumber by the country as a whole, and, Second, an increase in funds available for state and extension foresters to work out with the owners in each community plans for utilization of the chestnut.

In the older areas of blight infection, especially in parts of New York, Connecticut and New Jersey, practically all of the chestnut trees have been killed by the blight. We are making a study of the few trees which are at present known to have survived the blight with the possibility and hope that the progeny of some of the trees will turn out to be highly resistant or even immune to the disease. A tree should have resisted the blight under natural conditions for at least ten years before it can be regarded as worthy of consideration as a resistant tree. Many trees will throw off blight cankers and apparently do well for a few years and then quickly succumb to the disease. The Office of Forest Pathology desires to receive reports of exceptionally resistant American chestnuts, that is, trees which survive after nearly all of the chestnuts in the vicinity have been killed. Unusually resistant trees are recorded and examined at some later date. Nuts and grafted trees from the most promising are planted in the Experimental Chestnut Orchard at Bell, Maryland, for further testing.

This office is also interested in reports of Japanese and European chestnuts which have survived the attacks of the blight. The removal of infected limbs and the cutting out of trunk cankers on these exotic chestnuts will materially assist them in throwing off the disease, but we are primarily interested in trees which are naturally resistant.

In addition to blister rust and chestnut blight there are other phases of Forest Pathology which are very important in connection with extension work in forestry. For instance, the most reliable estimates now available indicate that the present volume of decayed wood or cull in the forests of the United States is between three and four hundred billion

board feet. If you give this volume of decayed wood a value as if it were sound timber, the heavy financial loss becomes evident. In future stands the loss from decay will be much less than at present because of the increasing control of forest fires which afford means of entrance for many of the cull-producing fungi and because of the shorter rotations of the second growth forests which follow our virgin stands. However, studies in this country and in Europe show that decay will continue to cause heavy losses in our future forest stands, and the means of controlling decay will continue to be a factor of no small importance in future forest management. For instance, the major part of the white pine now being cut in the East is second growth, yet the estimates show that 10% of this is lost from decay.

In the West one of the most promising steps in the utilization of the present defective stands to the best advantage and in the reduction of decay loss in the forests of the future was the adoption of the so-called Sanitation Clause. This Sanitation Clause is a provision incorporated in the timber sales contracts of National Forests, requiring that all diseased and dead trees marked for cutting be felled and the sound wood in them be utilized. The advantages of this clause as briefly summarized by Dr. E. P. Meinecke are as follows:

1. Elimination of snags and lowering of fire hazard.
2. Elimination of insect infested trees.
3. Elimination of diseased trees as sources of infection.
4. Step in elimination of undesirable species.
5. More space for reproduction.

6. Actual net gain of timber from the undecayed parts of trees formerly uncut.

7. Increase in amount of timber obtained without corresponding increase in overhead.

We cannot recommend in the East the exact sanitation measures which are possible in the West where the decay of many species has been carefully studied because the forest pathology research work needed is a sound basis for forest extension work in the East is largely untouched. Also, the decay problem in the East is much more complicated than that in the West, because of the much larger number of tree species represented. In the Southern Appalachians alone there are about 80 species, half of which are of commercial importance. We have been granted funds for forest pathologists at two of the Eastern Forest Experiment Stations and the prospects are bright for the development of the needed research work.

The best available information concerning decay in eastern forests was secured in connection with the McNary hearing from the answers of questionnaires sent out to blister rust agents, state and federal foresters, timber estimators, etc., and from some preliminary studies made by Dr. G. G. Hedgcock in the Southern Appalachians. Summarizing these data, the average cull in eastern hardwoods was found to be 19% and in eastern conifers, 8%. These percentage figures indicate that there is about 108 billion board feet cull in the eastern hardwoods and over 35 billion board feet in the eastern conifers, or a total cull in the East equal to nearly seven times the stand of eastern white pine. Such a tremendous loss from our already scanty supply of timber in the East warrants active measures to prevent its continuation in our growing forests.

Although the basic data for the application of some phases of the Sanitation Clause in the East are lacking, certain general principles of sanitation can be recommended. For instance, it is a very prevalent practice in many parts of the Southern Appalachians to leave decayed trees standing at the time of lumbering, especially in sections where there is no market for firewood. The result of this practice is something which can be called to the attention of an audience of woodlot owners because they are primarily interested in profits. One of the important factors in making woodland profitable is to make every bit of it productive. In making your pleas for protection of white pine, you refer frequently to the fact that white pine produces more profits than other species. The forest extension worker in regions with such defective stands does not need to compare a productive species with a less productive one, but simply to show that such decayed trees produce no returns at all, much less any profits. Decay is progressing as fast or faster than annual increment. The area occupied by these decayed trees contributes nothing towards its share of the interest on the land value, taxes and overhead and often makes it impossible to show net profit on the forest as a whole.

I noticed last year a farmer carefully replanting missing hills of corn in order to obtain complete utilization of his land, while in his adjoining woodlot there were a number of large hollow trees, some of which were occupying perhaps a hundred times as much space as a corn plant. Furthermore, these trees had been occupying this land for not one season, but for many, many years. Such a striking contrast in land utilization interested me and I talked to this farmer about the matter. He said he knew those old defective trees were not producing any net gain of wood but

that he had plenty of fire wood close to his house and there was no incentive to get them out; the situation had never been put up to him in that way. After talking a while the farmer said, "I is gwing to get shed of those trees somehow, if I don't do nothing but deaden them". He also told me what a splendid forest sanitation measure the practice of coon hunting was and how the Department ought to encourage coon hunting, as it resulted in cutting down so many hollow trees! We do not mean to recommend that blister rust agents start into coon hunting as night work to improve forest conditions, but a few words now and then about such evident facts as the removal of defective trees to put the forest woodlot on a producing basis and the utilization of chestnut before deterioration causes further loss in value will help the cause of forestry. We want to see the principles of the Sanitation Clause applied throughout the East and you are in a position to do a great deal to forward this movement.

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THE WORK OF THE BUREAU OF PLANT INDUSTRY

By Dr. W. A. Taylor, Chief of
Bureau of Plant Industry, U. S. Department of Agriculture.

The Bureau of Plant Industry was established 25 years ago. Before the establishment of the Bureau, research was carried on by several divisions, among which were the Division of Botany, Section of Foreign Seed and Plant Introduction, Division of Agrostology, Division of Pomology and the Division of Vegetable Physiology and Pathology. This latter division made the first organized effort to study conditions of controlling diseases of plants. Disease controlled by spraying was not known up to this time. There was also the Experimental Gardens and Groves of which the late Wm. Saunders who landscaped the grounds of the Department, and who brought together a large collection of shrubby plants and trees new to Washington, was long the Superintendent.

In 1900 there was a consolidation of the above divisions into the Office of Plant Industry. By Congressional act this later became the Bureau of Plant Industry with Dr. B. T. Galloway as chief. At the same time that our Bureau was formed there were also formed the Bureaus of Entomology, Chemistry and Soils, the Biological Survey, and the Forest Service. No separately organized extension work was carried on at that time, the main work of the Bureau being of research type. The project idea and the present type of organization began very early. Before the field stations were established there was cooperation between the Bureau and practical farmers in various parts of the country; the farmers following directly the advice given by the scientific men in carrying out the experiments suggested by them. The Extension Service was emerging out of

this informal cooperation with the farmers.

The advent of the chestnut blight brought to the Bureau a new phase of work, that of directly cooperating in the control of crop pests. This was the first time the Bureau participated in a campaign against a plant disease, on any other than a research and demonstration basis, and cooperation in this case was carried on between the Bureau and the State of Pennsylvania. The second big fight of this character was the citrus canker eradication campaign and the Bureau is cooperating with several southern states in this work: in Florida the fight has been carried on very successfully and today the state has been practically cleared of the citrus canker; in Louisiana and Texas, however, where the citrus industry is not so well established and where citrus is being grown in scattering groves there is still some canker. Since the blister rust is so familiar to you I will only mention it as one of the large plant disease control problems of the Bureau. Barberry eradication work for the control of black stem rust of wheat is quite comparable to that of Blister Rust Control.

There is a difference between the State and Federal activities and the viewpoint of the Bureau of Plant Industry is national. Our policy has been and continues to be, to pioneer in regions where there are great potential agricultural possibilities, as in the western edge of the plains and in the far western states where work is needed, leaving most of the agricultural research work in the states where agriculture is more firmly established, to the regular state agencies. The Bureau also pioneers in scientific work. The blister rust work is itself frontier work, that is it is experimental, and the ways and means of bringing such a disease as

blister rust under control had to be worked out. The states are now beginning to recognize the need of cooperating with the Federal Government in this frontier work in agricultural research. For example, there is the mosaic disease of sugar cane, in which the state of Louisiana is now cooperating with the Bureau of Plant Industry in Florida.

THE WORK OF THE FEDERAL HORTICULTURAL BOARD

By
R. Kent Beattie,
Pathologist in Charge,
Foreign Plant Quarantines, Federal Horticultural Board.

The Federal Horticultural Board is organized under the Plant Quarantine Act which became effective August 20, 1912 and has been amended three times since. The Federal Horticultural Board is composed of five members selected two from the Bureau of Entomology, two from the Bureau of Plant Industry, and one from Forest Service. Dr. C. L. Marlatt of the Bureau of Entomology is its chairman. There are two general types of quarantines-- foreign quarantines which affect the movement of plant material between foreign countries and the United States, and domestic quarantines which affect the movement of plant material between states and territories of the United States. The Constitution and Statutes of the United States have been extended by Act of Congress to Hawaii and Porto Rico. Quarantines involving their relations with the mainland are, therefore, domestic. Similar extension has not yet been made to Samoa, the Philippine Islands, the Canal Zone, Guam, and the Virgin Islands. Therefore quarantines relating to them are foreign quarantines.

The foreign quarantines and restrictive orders issued by the Secretary of Agriculture may be placed in five classes, as stated below:

Nursery Stock
- General, Quarantine 37
- Oriental Fruit Stocks, Quarantine 44
- Five-needle Pines and Ribes, Quarantine 7
- Avocado Seeds, Quarantine 12
- Citrus Plants, Quarantine 19
- European Pines, Quarantine 20
- Banana Plants, Quarantine 31
- Bamboo Plants, Quarantine 34
- Sugar Cane, Quarantine 15

Cotton, Restrictive orders
Seed Cotton, Cotton Seed, Quarantine 8
Cotton lint, waste and wrappings, Cotton Regulations
Cotton products, Cotton Products Regulations
Protecting against Mexican Cotton, Mexican Border Regulations
Protecting against cotton seed mixed with Mexican corn, Quarantine 42

Fruits and Vegetables
General, Quarantine 56
Potatoes, Quarantine 3 and Potato Regulations
Mexican Fruits, Quarantine 5
Citrus Fruit from the Orient, Quarantine 28
Sweet Potatoes and Yams, Quarantine 29
Avocados, Avocado Order

Cereals
Indian Corn from the Orient, Quarantine 24
Cereals from the Orient and Europe, Quarantine 39
Rice, Quarantine 55

Brooms, Broomcorn, etc. Quarantine 41

Christmas Trees from Canada, Quarantine 57

Very few of the above quarantines actually prohibit the commercial entry of material. Most of them are mainly regulatory. For the details of the countries involved and the exact plants regulated the quarantines themselves should be seen.

The domestic quarantines of the Department may be divided into two classes:

(1) Those between the states
(2) Those between Hawaii and Porto Rico and the mainland.

The quarantines between the states are related to specific pieces of investigation, control or eradication work being performed usually by the Bureau of Entomology or the Bureau of Plant Industry as follows:

Date Palm Scale, Quarantine 6, cooperating with the Bureau of Entomology and the Bureau of Plant Industry.
White Pine Blister Rust, Quarantine 26 and Quarantine 54, cooperating with the Bureau of Plant Industry.

Barberry, Quarantine 38, cooperating with the Bureau of Plant Industry.
Corn Borer, Quarantine 43, cooperating with the Bureau of Entomology.
Gipsy, Brown Tail, and Satin Moths, Quarantine 45 and 53, cooperating with the Bureau of Entomology.
Japanese Beetle, Quarantine 48, cooperating with the Bureau of Entomology.
Pink Bollworm, Quarantine 52.

Between Hawaii and Porto Rico and the mainland are the following quarantines:

Hawaiian Fruits and Vegetables, Quarantine 13
Hawaiian and Porto Rican Sugar Cane, Quarantine 16
Hawaiian and Porto Rican Sweet Potatoes and Yams, Quarantine 30
Hawaiian and Porto Rican Banana Plants, Quarantine 32
Hawaiian and Porto Rican Cotton, Cotton Seed, and Cottonseed Products, Quarantine 47
Protecting Hawaii against pests from the mainland, Quarantine 51.

Your relation to the work of the Board, as you will notice, comes in the second item under domestic quarantines and your familiarity with the White Pine Blister Rust work will illustrate to you the general nature of such work.

In illustration of the type of work involved in the enforcement of foreign quarantines, permit me to call to your attention some of the necessary operations. Naturally these quarantines are based on collected information as to the plant diseases and insects present in foreign countries, and we have here in this office cards filed of foreign plant diseases, occupying at the present time, as you have seen 182 drawers of cards. Under Quarantine 37 an effort is made to restrict as far as possible, the entry of foreign plant propagating material so as to reduce the danger of importing pests to its lowest terms. Certain plant materials for propagation are specified in Regulation 3 which may be imported in

unlimited quantities for immediate sale, and in Regulation 2 there are listed those things which may be imported without restriction. But for the most plants the entry of propagating stock is limited to such materials as are necessary for the purpose of keeping the country supplied with new varieties and necessary propagating stock, or for any necessary experimental, educational or scientific purpose. To properly consider and issue such permits, to date it has been necessary to study about 22,000 horticultural varieties of plants and decisions have been made concerning their availability in the United States. Records of these varieties are kept in the office.

In the enforcement of the cotton regulations it is necessary to discriminate between cotton in its different stages beginning with the raw cotton in the bolls or as it comes from the bolls up through the ginned cotton, the linters, the picker, the card and the final spun thread, with all of the different kinds of waste which come from the cotton machinery in the processes of manufacture. It has been determined with the assistance of the cotton experts, that after the cotton has progressed through manufacture to a point beyond the carding machine it is safe to consider that all seeds or pieces of seeds which may harbor the pink bollworm have been removed and that no restrictions are necessary thereafter except the necessary permits and inspection to determine the fact. Because cotton adheres to the material used for wrapping cotton bales, it is necessary to regulate, inspect, and, in some cases, safeguard bagging and other types of material of the kinds used in wrapping cotton, and to discriminate between the type which has been used on foreign cotton and that used on American cotton. It is also necessary to regulate those cotton

products which may be contaminated with cotton seed which might harbor this insect. Large fumigation plants have been built by commercial concerns at Boston, New York, San Francisco, Portland, Oregon, Astoria, Oregon, and Seattle, Washington, for the fumigation of cotton and cotton products, and some bagging is sterilized by being macerated into paper at approved paper mills in the northern states. To guard against the entry of cotton seed with other products on the Mexican border, large fumigation houses holding from six to twenty freight cars at one time have been built and are operated by the representatives of the Federal Horticultural Board at Brownsville, Laredo, Eagle Pass and El Paso, Texas, and Nogales, Arizona, and a house for motor trucks is located at Del Rio, Texas. The principle involved in the vacuum fumigation tanks is the same as that exhibited to you in the inspection house at Washington. The principle of the Border fumigation houses for freight cars is the same as the fumigation boxes at the inspection house.

Additionally safeguarding the entry of special permit material for propagation, it is brought to Washington for inspection and the material exhibited to you at the inspection house was largely of this nature, although in one room at the inspection house were numerous small lots of material introduced by the Department of Agriculture itself. Inspected here at Washington, this material may go into quarantine or may be released for propagation, distribution by, or research in the Department.

THE WORK OF THE OFFICE OF EXHIBITS

By
J. W. Hiscox,
In Charge Office of Exhibits, U.S. Department of Agriculture.

The work of our Office is that of preparing and transporting the exhibits of the Department of Agriculture. About five years ago the Office was given an appropriation for making exhibits at State, Interstate, and International Fairs, at first in cooperation with other Federal Departments. Up to that time the Department of Agriculture had received special appropriations at various times for preparing and staging exhibits for particular expositions.

During the war several of the Departments cooperated with our Department in putting on large exhibits. Of late years, however, the other federal departments have dropped out of the exhibit work so that today there remains but the one department, that of Agriculture, which carries on exhibit work as a regular feature of their work.

Formerly the various Bureaus in the Department put out their own exhibits and there was little coordination between the work of one bureau and another, either in the kind of material used, the lettering of labels, the mounting of specimens, etc. Now the Office has its own workers who get up uniform exhibits of novel form, to appeal to the particular kind of exhibition that is staged.

Under the terms of the appropriation acts we now can exhibit only at State, Interstate, and International Fairs. We have to drop exhibiting at other fairs even though the local fairs would pay the expenses of transportation. The feeling is growing in the Department that we should exhibit at smaller fairs as well as those at which we show today.

Mr. Green will conduct you to the third floor where you can see various types of exhibits such as we use today.

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In response to questions as to the educational value of exhibits in illustrating scientific truths, and better methods of farming practice, Mr. Hiscox stated there was overwhelming evidence as to the value of exhibits put out by the Department of Agriculture. Managers of fairs who in former years turned down an offer of the Department to send an exhibit have lately changed their tune completely and have begged the Department to send their exhibits.

CURRANT AND GOOSEBERRY VALUES AND SUBSTITUTES

By G. M. Darrow

Office of Horticultural and Pomological Investigations
U. S. Bureau of Plant Industry.

Values. -

To get at a fair valuation of a bush or plantation of these fruits actual records are needed. Mr. Atwood, director of the New York State Bureau of Plant Industry, this winter secured from several New York growers information on this which Mr. Detwiler sent over to me. An examination of these with certain details of the culture of currants and gooseberries in mind should give a basis for estimating the value of the bushes in any case.

The bushes are commonly set 4 feet apart in rows 8 feet distant or 1360 plants per acre. The bushes are at least four years old before coming into full bearing. Then 5 to 15 full crops are harvested and the plants destroyed. I have, however, seen small plantings which have been bearing for about 30 years and were still productive. Probably an estimate of 10 to 12 productive years is fair.

These reports of New York growers give an average of 158 bushels or approximately 5,000 quarts to the acre, 4 quarts per bush. The larger yields reported are as high as double this and are from the specialized small fruit section of the Hudson River Valley. There undoubtedly is such a variation in yields from good fields as this indicates.

The average value of the land is given as $343.00, ranging from $50 to $1000 per acre. I believe this much too high, an average of $250 per acre and a maximum of $500 being nearer correct. The cost of planting

stock varies from $40 to $175 per acre, with an average of $108. This is approximately correct, perhaps a little low. Currants are listed at 5 to 15 cents each by the thousand at nurseries but are much higher in small quantities. The difference in cost is due to the difference in age of stock and in the variety. The home garden plants probably cost an average of at least 30¢, often more.

The average return per acre for plants in full bearing is given at about $400 per acre. From this must be deducted the cost of picking, packing and shipping, or approximately one half of the gross return.

The cost of cultivation, pruning and fertilizing per year is given at from $40 to $105 or an average of $65 per year. Although hardly a usual condition, a paying crop is reported from all but one grower when it was two years old. The growers' investment is then:

Planting stock	$108
Planting	21
Cultivation 2 yrs.	130
Interest Charges	69
Total cost of bearing plantation - -	$328 or 24¢ per bush.

Such costs are of course for commercial plantings. The average home garden bush will certainly cost more than three times as much or approximately 72¢. Therefore the profit per bush will be reduced over that of a bush in a commercial planting.

The returns, deducting picking, packing and shipping charges average $77.00 per acre the second year, $117.00 the third year, $199.00 from the fourth year to the seventh year. (See table I) and $174 from the 8th to 12th year (average yield and value per acre estimated at 1/8 less for this period when bushes have passed their maximum production capacity) On this basis the total returns in a twelve-year period amount to $1860.00

per acre, no allowance being made for years when crops or prices fall below average. From this total must be deducted $108.00 per acre for planting stock, $21.00 for planting, $35.00 per year for interest and taxes and $65.00 per year for cultivation and care. The total deduction is $1329.00, leaving a clear profit of $531.00 per acre for the 12-year period (which is the life of the plantation) or $44.25 per acre, per year. At the rate of 1360 bushes per acre, each bush yields an annual profit of 3.2 cents. This same return is obtained by investing 53 cents at an annual interest rate of 6%. Fifty-three cents then is the value of an average bush in a commercial plantation. It would be proper to calculate compound interest on the investment, but it was deemed sufficient for our purpose to use simple interest. It appears that if all reasonable allowances are made, that 50 cents per bush is a fair valuation on a mature plant in the best of condition. Neglected plants can be valued and classed only by one on the spot.

In regard to the compensation for nursery stock I have no information on the value of this material. It would seem as though the compensation schedule for New York State was fair except for stock plants from which currant cuttings are secured. If a nursery was required to change its location rather than to give up currant propagation the loss of its stock plants would entail a loss of several times the compensation schedule of 50¢. However, this sum would be fair for such bushes if currant propagation was to be discontinued.

Income per acre is given in reports secured by Mr. Atwood. These vary from $154 per acre when two years old to $398 per acre when in full bearing.

If any change is made in the schedule it should be in the payment for good bushes in home gardens or plantings of less than 100 bushes.

PROFITS FROM COMMERCIAL CURRANT PLANTATIONS

Summary of Information Obtained from Certain New York Growers by Mr. George G. Atwood, November 1924.

Commercial Red Currant Fruiting Plantations

Table I.

No.	Number bushels per acre	Value of land per acre	Cost of making plantation		Cost of Cult. pruning and fertilizing, per yr.	Age when plantation not profitable
			Stock:	Planting:		
1.	125-175 bu.	$200 (near city)	$175	$25	$80 not incl. harvesting	15 yrs.
2.	8000-10000 qts. (250 to 312-1/2 bu.	$700-1000	$100	$25	$105 Wilders Fuller & Fays	8 yrs. 15 "
3.	120 bu.	Depends on location	$100-200	$20	$50	10-15 yrs.
4.	50-60 bu.	$300				40 yrs.
5.	200-300 bu.	$200-500	$40-60	$25	$50-75 (picking 50-75)	10-15 yrs. acc. to variety
6.	80 bu.	$300-700	$89-1 yr. $120-1 yr.	$25	$40	20 yrs. if well kept.
7.	170 bu.	$50	$100	$10	$50	12 yrs.
8.	Currant crop most profitable of small fruits except raspberry					
Avg.	158 bu.	$343	$108	$21	$65 not including harvesting	17 yrs.

PROFITS FROM COMMERCIAL CURRANT PLANTATIONS

Summary of Information Obtained from Certain New York Growers by Mr. George G. Atwood, November 1924.

Commercial Red Currant Fruiting Plantations

Table I Cont'd.

Yield and Value per acre			Relative value red, white and black currants and gooseberries
2-yr.	3 yr.	4-7 yrs.	
1. 60 bu.	95 bu.	154 bu.	White and black currants about half that of red; gooseberries about same as red currants.
2. 2000 qts. at 6 cents per qt. Price includes delivery to station.	4000 qts.	9000 qts	1924. Red and Double Red $75 per acre. No white or black currants.
3. Not much yield	$100	$200-400	White currants not much in demand; black currants sell 10-12¢; gooseberries 6-8¢
4. (Impossible to estimate)			Red first
5. $200-250 2000 qts.	$300-375 6000 qts.	$400-500 8000 qts.	1. Gooseberries. 2. Red currant. 3. Black Currant. 4. White currant.
6. $100-40 bu.	$150-60 bu.	$200-80 bu.	Red currant 10% less than others.
7. $170-1/3 crop	$340-2/3 crop	$500	Red 10¢; white not salable, Blacks 15¢, Reds and Blacks pay equally well, as Reds outyield Blacks. Figures based on 10 acres of currants under good care and cultivation.
8. Early season 12-1/2-15¢ per qt. Later 9-12¢			Grows Fays Prolific, Red Cross and Perfection type. Discarded Red Dutch, etc.
$154	$233	$398	
Average crop value per acre after deducting picking, packing and shipping charges.			
$77	$117	$199	

Substitutes

Our country has been prosperous and a pleasant place in which to live because two basic food requirements have been met; first, its food supplying power has been sufficient for its population at all times and second, many major food crops are grown so that if there is a shortage of one crop the condition causing it is likely to favor another crop, thereby maintaining an average food supply. The great number of our minor food plants some of which have from time to time become major crops, are essential in maintaining the balance of supply and demand and our standards of living. The loss of even one of the minor food plants of the country becomes a matter of concern to the nation. No restriction or eradication should be considered except as a final resort.

In the case of the currant and gooseberry, urgent necessity demands restriction or eradication, that urgent necessity being the saving of a major timber crop. One timber crop, the chestnut, is already disappearing. As a consequence, costs of many articles formerly made from the chestnut will rise and fluctuate more widely than would have been the case if the chestnut bark disease had not been established here. Horticulturists recognize this condition and are, for the most part, like-minded with foresters and forest pathologists in their attitude toward measures to be taken. We value the white pine and believe in its preservation. We are interested in and wish to help in affecting all measures of safety. We believe in the establishment of "white pine regions" and of "currant and gooseberry growing regions" and though we like our fruits we value the pines more.

Some of us still need educating, however. We think about blister

rust for but a few minutes a year. Most horticulturists are teachers and if the State Extension Horticulturists, the full horticultural teaching staff of the various agricultural colleges, and, in many cases, the students of horticulture as well, could be invited to a field demonstration of the operation of the blister rust disease you would be building up a cooperating group which should make your work much easier and much more effective. Horticulturists are like the rest of the population, quick to criticize and unless they understand your work will not give it the support it deserves. If any of you so much as pull a flowering native currant, mistaking it for the European black currant, it will be talked of for years to come.

The next step in the horticulturists' blister rust program is to develop better varieties of currants and gooseberries for those areas designated as currant and gooseberry-growing regions. To this end breeding work is being carried on at several stations. Promising new currants have been originated and are now being propagated and introduced at the Minnesota and North Dakota stations and at the Mandan Station in North Dakota, of this Department. The Minnesota station has also introduced a new gooseberry. The development of currants and gooseberries, which are among the few fruits which are hardy in the northern plains area, should be encouraged and horticulturists look to you for cooperation in the furtherance of this interest.

The third step is to develop other fruits to replace currants and gooseberries in regions where they are to be banned or restricted. If an equally good or better fruit can be recommended in their place the process should not be difficult. A survey and test has been made and is

being continued of all promising plants. Among these are:

1. Prunus tomentosa, a bush cherry
2. Prunus glandulosa, another bush cherry
3. Prunus gracilis, the bush plum and its hybrids
4. Prunus maritima, the beach plum
5. Prunus virginiana, chokeless chokecherries
6. The Vladimir, a dwarf sour plum
7. Viburnum americanum, the American cranberry bush.
8. Dwarf apples and crabs
9. Elaeagnus multiflora, the goumi
10. Elaeagnus umbellata
11. Actinidia arguta
12. Pyrus acuparia dulcis, the mountain ash
13. Sambucus canadensis, the elderberry
14. Berberis SPP.
15. Shepherdia argentea, the Buffalo berry

Many other plants have been studied and several are being tested. 1. Of these, two are promising, one Prunus tomentosa, has the prospect of being more valuable for the home garden than the currant and gooseberry ever were. Its fruit is larger than the common gooseberry, it contains sufficient pectin to form a good jelly which in color is equal to that of the currant, and the bushes are more vigorous and far more productive than currants. Moreover, it is good to eat out-of-hand. It is apparently hardy as far north as the currant and gooseberry in eastern North America. The Office of Foreign Seed and Plant Introduction has a stock of fine selections of this cherry and will have some available for distribution in 1925-1926. The original of these bore at least a bushel of fruit each in 1924.

Sweet cherry varieties may be self and intersterile and there is some evidence that this is the case with the bush cherries. Several selections are, therefore, being propagated with the expectation that cross pollination will be effected. Large numbers of seedlings are being grown from which to make further selections. Mr. Dorsett of this Bureau

expects to visit Manchuria next summer to secure additional selections.

2. The largest American cranberry bush plantation is at East Lee, Mass. Additional plantings are located at the Maine, N. H., Mass., and New York Experiment Stations and at the New York State Forestry Nursery at Lake Clear Junction in the Adirondacks. Selections have been made and are being propagated. It makes a slow growth from cuttings, however, and will not be available in quantity for several years. In the meantime, we are supplying nurseries with seed of our selections, in the attempt to replace the bitter European form with desirable native seedlings.

With Prunus tomentosa as a first-class bush fruit and with the American cranberry bush and many other berry and small fruits of greater or lesser value it should be possible to offer fully satisfactory substitutes for currants and gooseberries.

2. Prunus glandulosa. - This bush cherry comes from Manchuria and ripens in August. Selections of seedlings are being made. It is rather promising for the Minnesota and North Dakota region.

3. Prunus gracilis and its hybrids. At Rochester, New York, many seedlings of this type of plum from the height of 2 to 8 feet are fruiting freely. They make good jelly and are hardy and productive. We are growing seedlings in the hope of getting a desirable selection.

4. Prunus maritima. - This is the beach plum, native to the coast from Maine southward. It is prized as a jelly fruit above the cranberry, by many cranberry growers of Cape Cod. We will have second generation seedlings from crosses with other plums in fruiting this year.

5. Prunus virginiana.- Chokeless chokecherries for eating and jelly have been selected in Manitoba. We are securing propagations this spring

of one selection.

6. Vladimir cherry.- This dwarf sour cherry is hardy in Manitoba and some seedlings of it are very promising there. It is of promise for the Minnesota and North Dakota region.

8. Dwarf apples and crabs.- There are dwarf apples and crabs suitable for small gardens. Selections of these are being made.

9 & 10. Elaeagnus multiflora and Umbellata are both fine jelly fruits and are being tested and seedlings grown for further selection.

11. Actinidia arguta.- This relative of the grape is hardy in Massachusetts and New York and sometimes bears full crops of fruit somewhat like the fig but the size of a small plum. The cause of its irregular fruiting is being studied.

12. Pyrus acuparia dulcis.- This form of the mountain ash is most promising but like the American cranberry bush has bitter fruited relatives to give it a bad reputation. It is a beautiful ornamental and bears immense clusters of fruit which yield a fine red jelly.

13. The elderberry is under the ban just now because of the ordinary use to which the fruit is put but to us who have learned to enjoy pies and jelly made from it, it should have a place in every garden. We are continuing to make selections and hope to have some worth-while ones available when the present spirit of lawlessness disappears.

14. Berberis SPP. The late Dr. Walter Van Fleet in his breeding work selected a fine fruited form which we find is a desirable jelly fruit. We still are having propagation difficulties.

15. Shepherdia argentea.- The Buffalo berry is at present confined to the Great Plains area. Tests in the East prove it to be adapted to this

area and it may prove to be of some value.

Our hope is to revolutionize the home garden of the North in giving the grower a great variety of desirable small fruits to choose from. We are also working with the strawberry, raspberry and blackberry in attempting to breed varieties of far greater value to the home garden so that the currant and gooseberry will not be greatly missed.

RESEARCH ACTIVITIES OF THE FOREST SERVICE.

By Earle H. Clapp
Assistant Forester in Charge Branch of Research
United States Forest Service.

(Address and discussion at Extension Conference)

It always comes to me very much as a surprise when I look over our forest statistics and find the very large extent to which the farmer is interested in forestry, from the standpoint of landownership, because the farmer owns altogether pretty well toward one-third of our total area of forest land in the United States. He is interested also from the standpoint of utilization of forest products. Well up toward half of our population is rural, and I suppose that the per capita consumption of lumber on the farm is about the average for all classes of citizens, so that in consumption of lumber, which is one of the large elements in the drain on our forests, the farmer takes nearly one-half, possibly more than one-half. Lumber represents one-third of the annual drain on our forests. The largest element of the drain on the forest is fuel wood - about 40%, and of that the farmer uses a very large percentage. The third element in importance is fencing, and of that of course the farmer uses a very large proportion. These three classes of products make up about 80% of the total annual drain on our forests, so that you can see the importance of a farmer as an owner of forest land, and as a large consumer of forest products.

It follows, of course, that the farmer is interested to a very great extent, both directly and indirectly, in all classes of forest research, whether that research deals with the growing of timber or the

utilization of timber, or the production and utilization of by-products, or other forest problems, which must underlie all forest activities and forest policies.

The production of timber on the farm is an important element in diversified farming. To bring about a realization of that we made, a number of years ago, some rather thorough-going studies of the marketing of the forest products on the farm, and published the results in one general bulletin, (Farmers' Bulletin No. 1210) of which I have a copy here, "Measuring and Marketing of Farm Timber," and in a series of State bulletins, which are more detailed in their character. Now that general bulletin covers the questions which anyone ought to know as to sale of timber, or to know in order to sell to the best advantage; how to estimate standing timber; how to scale timber after it is cut; what forms of selling contracts are best; how to get competition, and things of that sort, and of course an attempt is made to cover all these questions, some of which are rather technical, in as non-technical a way as information can be given.

Another effort to get at the same question is an investigation we have had under way for the last two or three years on stumpage values and log values. In cooperation with the Bureau of the Census, we have sent out something like 10,000 questionnaires a year to all people buying or selling timber asking them to give the price that they have been receiving or paying for different classes of products in the standing tree and the like, and that data is being worked up, and combined with other material, it is going to show the value of forest products, and the stability of the value of forest products or lack of fluctuation. It will probably show,

for most kinds of timber, a steady increase in value over since we have had records. That is a thing of a good deal of importance, considered with the fluctuations in price that occur for other products. If the farmer has a product that he can turn to when other prices are low with great assurance of being able to get high prices, constantly increasing prices, it will help to emphasize the value of the farm woodlot and the products that can be received from it, and the place of the farm woodlot in diversified farming.

Those are just two examples of economic work in the Forest Service. There are a few others, although the number of men that we have for economic work is very small.

One thing that may be of interest is the comprehensive work in forest taxation, which we hope to begin about the first of July. We have under way a study of transportation - transportation relative to consumption prices on one hand and the value of timber on the other, because in the last analysis transportation is a controlling factor in both.

Then we have done more or less work on questions of supply, timber requirements, timber consumption, etc. For the most part, it is the compilation of material which other agencies have collected, and its interpretation from the standpoint of forestry and forest development.

Taking our economic work in general, I think possibly its great value to date has been as an aid in crystallizing public opinion on forestry. For a good many years forestry was talked of in generalities but our economic work, meager as it is, had to be given in definite figures, some approximate to be sure, but accurate enough to be used, and I think it has developed a popular conception of the need for forest development.

I spoke of the area of forest land in the farm woodlot; it is approximately 150,000,000 acres out of a total forest land of 470,000,000 acres, but it is situated in the most part in very productive sections of the country, that is from a timber standpoint, in the Central Region and the South, and it is probable that the potential timber growth on this area is more than one-third of the total potential growth for the entire country, so that the farmer ought to be interested in anything that we can do to help increase the growth on the farm woodlot.

One of the things that we have under way now, in lines of work that might be of interest in this connection, is a series of reports, about 12 or 13, covering each of the important forest regions of the United States, summarizing for each of these regions the measures which are necessary to growing timber: First, the simplest methods that can be used, those that will keep forest land productive, those that prevent forest devastation as a deadline, and then supplementing that for each region a briefer discussion, possibly outlining some desirable measures or desirable practices. In this series of reports will be brought together all the information available from the Forest Experiment Stations, all the information that has been supplied by all the other agencies, to cover all the situations in the simplest possible non-technical terms. They are desired primarily for the large timber-land owner, but there is no reason why they should not be equally valuable to the small timber-land owner. They have been under way for two or three years, and the most advanced section of the reports will be ready for submitting to the Department within two or three months for printing.

MR. GRAHAM: When will it be out?

MR. CLAPP: I did not say anything about that. I hope that we can get the first sections to the Department within 3 months or less. I presume it will take the usual time to get the thing through.

MR. GRAHAM: That is the interesting part of it.

MR. CLAPP: Now that is a part of the work of our Forest Experiment Stations. We have a program for Forest Experiment Stations which contemplates ultimately the establishment of one regional station in each of the 10 or 11 important forest regions of the United States. That program has been outlined in a departmental circular (No. 183). We have made reasonable progress in attaining that program. We have four Forest Experiment Stations in the East, one in the Northeast, one in the Appalachian Mountains, one in the South, one in the Lake States. We have two fairly well supported stations in the West - the Northern Rocky Mountains and the Pacific Northwest. We have smaller stations in Colorado and the Southwest and have done a little work in a general way in California. They are all comparatively recent. The oldest was established in 1908. The first stations were established in the East in 1921; two more were established in 1923, so you will see that our Eastern stations are just getting under way. Practically all were preceded by more or less general work.

I will speak very briefly of the general lines of work that these stations are covering and then pass on to another line of research. One of the first questions we have to study and be prepared to answer is "What will the land produce?" "What will it produce in different kinds of timber - growth and yield?" Upon information indicating growth and yield must depend the business policy of the owner; whether he is a farmer or

whether he owns a large tract of timber, or whether the land is under public ownership, national or State. Studies of that character are now part of the program in practically all of our experiment stations, East and West. We have preliminary data now that we can give out to anyone that is interested.

I have spoken of methods of growing timber. All of our stations have projects of that character dealing with the most important types. Of course we have not had resources enough to cover all of them, so we concentrate on the most important types in the regions. We have studied artificial planting mostly in the West. Methods have been worked out in the East by our Forest Schools and the States.

One of the lines of work we have taken up recently at the experiment stations is protection from fire. It has been and is now very largely a rule-of-thumb process, but we find that a great deal can be done in an experimental way as a basis for fire protection. In cooperation with other agencies, especially the Weather Bureau, we are trying to find out just what actual fire conditions are, to get some measure of them, then to go from that into the climatic predictions, so that actual conditions can be anticipated and prepared for. Fire damage is very great in many sections of the country. The general public often does not know what fire damage is, and thinks there is none. There is a large amount of fire damage, and we are making studies to find out just what it is. We have a lot of work under way in the West in connection with forage use in grazing. We have also a project in the South in cooperation with two other bureaus of the Department and some State agencies. Of course we have under way, and have had for a good many years, studies of

trees, their life history, requirements, and all the information we can get on them which will help in the handling of trees in forest growing. Then we have made some fundamental investigations of soil requirements, and light requirements, etc.

Now our problem of timber supply is too large to be solved solely from the standpoint of growing timber. We have waited too long for that. We have to attack the problem at the same time from the standpoint of utilization. I may say that something like two-thirds of the timber cut each year is lost in manufacture and subsequent use, and a good deal of it unnecessarily. So we think that through our investigational work we can make better timber utilization attack the whole question of timber supply in a vital way; an effective way. One of the most important sources of loss is through decay. The Bureau of Plant Industry is doing a great deal of work on fungi which cause rot in timber, their life history, and what to do in the prevention of decay. One of our sections at Madison is working on preservative treatment of timbers. This work is of interest to the farmer, for one phase of it bears on the possibility of preservative treatment for such products as fence posts, silo material, telephone poles, etc. Here again we have a farmers' bulletin, (No. 744) on preservative treatment of farm timbers, with a revised edition issued as recently as 1923, which contains the information that any man needs on simple preservative treatments for fence posts and the other classes of products that I have mentioned.

Another line of forest products investigations which touches the farmer more or less directly is that on box containers, crates, etc. That work had its origin in a lengthy and very comprehensive series of tests

on the strength properties of the material. These strength tests have been going on for 10 years or more, in accordance with a systematic program under which we want to cover eventually all of the timbers of the United States. We think we have covered the most important. After getting that information on the strength properties of wood we naturally got into testing products made from wood, such as crates, boxes and containers. A special system of testing apparatus has been developed for these tests. It includes a drum which tumbles boxes; another machine which gives a weaving motion similar to that which every box that is shipped in a box car in a train is submitted to; another which lifts a box up and drops it; another with pressure on the corners, etc. We try to test boxes with the contents which they are supposed to carry. It is nearly always possible to get something that corresponds very closely with the article and take it through such experiments as just described. One manufacturer of shoes was getting complaints from purchasers about the poor condition in which their shipments arrived. Some of these purchasers knew of this box testing work under way. The manufacturer was urged to have his boxes tested. He did not think it would do any good, but finally decided to have it done. A box was made up under his directions, placed in the tumbling drum, the drums revolved about six times and the box went to pieces. Our man had tested boxes of this sort before. He took the same box, put a few more nails in it, and put it back in the drum and it stood the test several times more severe. That was all that was necessary to convince the shoe manufacturer. Out of it all is growing a set of principles which cover the construction of boxes, crates, etc., the thickness of material, seasoning of material, storage

in moist places or dry places, mailing, comparison of value of different kinds of wood, and similar questions.

We have worked on quite a few boxes in which the farmer is directly or indirectly concerned, for instance, canning boxes - a great many tests have been made on these, perhaps more than on any other. Apple boxes, baskets, vegetable crates, etc., have also been tested. Most of this work has been done for associations.

I think possibly the results of these box tests are being applied more generally, more rapidly, than any other investigational work that we have attempted at our Forest Products Laboratory. Quite a number of the manufacturers of boxes have equipment of their own, and they are making tests for purchasers of their boxes as a part of the service which they render.

I will speak of only one more line of forest products investigations; that is glues. The time is getting short, and I will have to do that very briefly. We got into an investigation of glues during the war in connection with airplane parts, and particularly in the test of hydroplane parts. A great deal of trouble was experienced because of the different parts the plane was made of. Our work has been mostly on the development of more water-resistant glues. We have worked very largely on casein glues and albumen glues, both directly or indirectly agricultural products. The whole glue proposition when the researchers started was on a rule-of-thumb basis. I doubt if any investigational work had been done on it. In addition to the development of a number of new and better glues, the work has resulted in standards for gluing, so there is a greater possibility of getting better quality glues. Of course we have

had to work out a lot of questions as to the application of glues on timber, how much applied, pressure, nature of surface of wood, and a good many questions about which before the work began, no one knew anything. Now this work, as I have said, has been done very largely at the Forest Products Laboratory. Our products work was begun at a number of forest products laboratories throughout the country, mostly in colleges and universities, but we found that it resulted in a duplication of work. A large part of the work is now concentrated at Madison in connection with the University there and the Bureau of Plant Industry, and that concentration gave the work a wonderful impetus.

I have spoken of strength properties, and investigational work along that line. We have done a good deal of work on the physical properties of wood, transmission of moisture and heat, and such properties as that, which are a basis for seasoning wood by air or kiln drying, and gives us the information we need to get at working, checking, and such things which make wood difficult to handle. Then we have studied the chemical properties of wood and their application in such things as paper making, in making alcohol, etc. It is possible to make a very high grade of grain alcohol from wood.

Then another group of investigations deal very directly with the problem of waste, in logging, in primary manufacture in the sawmill, and in the remanufacture at plants such as furniture plants, etc. One class of this work has led to new grading specifications, practically uniform for all sections of the country, that are now being gradually adopted by association after association. This work has been handled in its latter stages in cooperation with the Department of Commerce.

I think I have taken about all the time that I should, I have had to cover a rather large field in a very general way and a few specific lines of work perhaps in more detail. Much of our work, I should say, started in the field in which practically no scientific work had ever been done. Much of it as a result, has had to be preliminary. It has been very easy for that very reason to produce results of value for immediate application, whether in timber growing or timber utilization, and that general work has been a very great help in giving us a real appreciation of what the fundamental problems are, and which we ought to be working on. Quite a good deal of the general preliminary work has been covered now, and our work more and more is going to go into the fundamental questions, which will serve as a real basis for the development of forestry.

Just one more thing in conclusion. Although our job is mostly a research job, we have a very real conception of the fact that it does not stop there; that to be of value to the people in the United States the results must be put into use. We want to help all we can in getting results into use, but we know we can't do it all. We want to get all the help we can from the Extension Department, the States, and every organization in the United States that is interested.

MR. GRAHAM: I hope in the few minutes we have left you will ask questions.

MR. PIERCE: If I were a timber owner in New Hampshire and had a forest problem, should I write to the Amherst office or take the matter up with the Washington authorities?

MR. CLAPP: I would say take it up with the station at Amherst, because we would refer it there anyway.

DR. BELL: Do you have much trouble with gophers, field mice, etc.?

MR. CLAPP: There has been quite a serious problem with pack rats; in some parts of the West rats are the most serious obstacles to planting. Porcupines also cause considerable trouble.

DR. SMITH: Have you figured out about what acreage must be replanted each year so that production meets consumption?

MR. CLAPP: We figure it in this way: Present drain about 25,000,000,000 cubic feet a year, which is probably a conservative estimate, because of the destruction and damage by fungi and insects. The potential production on the entire forest area of 470,000,000 acres totals about 27,000,000,000 cubic feet a year, so that is a partial answer to your question.

DR. SMITH: That is the forest acreage that is not now planted?

MR. CLAPP: 470,000,000 acres includes cut-over land, burned-over forest land, some covered with undergrowth and stuff that has got to be taken off before anything can be planted. It is not necessary to plant all the cut-over areas. What the Forester tries to do is to cut the timber in such a way that he won't have to plant, because he can ordinarily get a new growth by the way he cuts. Some of the European countries that relied almost exclusively on planting are getting back to the natural reproduction. Their experience in artificial planting has not been satisfactory. The amount of planting to date by all agencies is ridiculous. It has not made the slightest impression.

DR. SMITH: The Lower Peninsula of Michigan has been cut over without leaving seed trees. What are they going to do to be saved? Never will they reforest unless it is replanted.

MR. CLAPP: Some will have to be replanted; I can't tell just how much. Quite a good deal of the rest with a preliminary crop of oaks, etc., will gradually be replaced by better species, if they can keep fires out and give the better species a chance. It is going to be a long slow process.

MR. GRAHAM: Mr. Clapp has made a remark that has interested me in his figure of resources. If that calculation, Mr. Clapp, had been made 30 or 40 years ago, would the statement have prevailed then that you are making now? The point I want to bring out now is, do we consider the probability in the inventory of working out substitutes of the quality established in timber?

MR. CLAPP: Unquestionably there has been a great deal of substitution up to the present time. The whole question of substitution is very complicated. It is one of which general prediction is rather unsafe; not always, but very frequently you will find that substitution in one line is more than offset by increased use in another. Now substitution in some articles is a very good thing. We get a more useful, more valuable product. In others the substitution is not desirable - we would rather have wood if we could get it. Most substitution is by unreplaceable products. We can grow wood; we can grow it indefinitely. I gave you the figure of the present drain on our forests. Our population is increasing, and even though consumption should fall off, as it will have to, it is pretty likely to stay just where it is, and it is now below a desirable point on account of the high prices for forest products. In a number of European countries, England for example, the per capita use of forest products, in spite of industrial development, has been steadily

increasing for 40 or 50 years, and I imagine that is true of Germany also, although I do not have figures, so the chances are we are going to need at least as much timber as we are using now, probably more.

DR. BELL: I would like to ask in regard to the wooden boxes and crates. Has the total amount of wood increased or decreased as to the substitute of the amount of wood used in crates?

MR. CLAPP: I do not believe I can answer that question right now. A number of years ago I remember looking it up, and at that time I thought there was a falling off in the use of wooden boxes through the substitution of fiber boxes, which is pretty largely wood in another form.

MR. GRAHAM: I saw a very interesting thing going on in a Western State a few months ago. A boy, whom I once knew, had an industry which was centered about a few lathes. He was getting all his timber from other industries. That man goes into these places and buys that oak or other lumber as nearly as they can estimate it at $14 a thousand, and he makes nearly $500 on it. He has built up a tremendous industry there, making toys, etc., down to things the size of a pen holder. It seems to me, Mr. Clapp, that there is a type of industry that is built up no doubt from the waste in other industries.

MR. CLAPP: One of the most interesting investigations that we have had under way in the last two or three years fits right in with the thing you have described, the possibility of getting at the sawmill and at hardwood mills chiefly, products cut to the size that they will be needed at the turning plant, the furniture plant, etc., instead of cutting the log first into lumber, with a waste of 35% to 50%.

MR. GRAHAM: What value would that have on the stumpage?

MR. CLAPP: Everything we can do to increase utilization tends to increase the value of the crop. There is no question in my mind about future stumpage increasing. We are cutting very rapidly our remaining supply. Seventy-five per cent of the total cut of high grade timber is from the virgin forest, something we are not responsible for in any way whatever. It seems to me that the further reduction of what we have can only have one result in stumpage value. In the middle west - Ohio, Indiana, Illinois - hardwood stumpage is steadily on the increase. Timber there is selling for $30, $40 and $50 on the stump. In exceptional cases it is selling up to $200. These prices are higher than pre-war prices in France and Germany, under which timber was grown for many years.

MR. HARTLEY: Is there much likelihood that the stumps themselves will grow in value?

MR. CLAPP: Yes, I think so for some species. Some of the pines, for example, can be distilled for turpentine, and after the turpentine is taken out the residue can be used in pulp making. Black walnut stumps of course have a value, and the tendency is to cut low stumps.

MR. GRAHAM: Have some of these forestry propositions had any bearing on the cotton boll weevil difficulty?

MR. COLLINGWOOD: We had a conference on that in Mr. Evans' office not long ago, and one of the men from the Office of Investigations on boll weevil made the statement that so far as he knew the boll weevil does hybernate throughout the winter in the Spanish moss, possibly in the rough bark of Southern pines; that, however, the practice, which is common all through the South in burning the woods to kill the boll weevil

did scarcely any good in killing this pest, but did a tremendous amount of harm. He could not actually say to what extent they actually hybernated in the bark, but he did know they hybernated in the moss, and that close to the edge of the woods where the cotton field adjoins it there will be a thick infestation of weevil, and on that narrow strip they could recommend special measures for controlling it, and by using that as a trap area they could relieve their efforts on the center of the field. He recommended and urged against the burning of these Southern woods, and he made a statement which Mr. Mattoon took with him when he went South in order that he could show it to the Southern agents.

MR. GRAHAM: I was up in North Dakota at one of their conferences this winter. They were debating whether they should go into the sheep industry or not. Around that involved the problem of fencing. The thing that prevented them was the freight rate. John Hall, who used to be county agent there, now with the Northern Pacific Railroad, took up the matter and got them to cut poles from Northern Minnesota at a freight rate at which they could build fences, shelter, and whatever is necessary for those sheep, and I think John Hall did a mighty fine piece of work when he got the Railroad Company to put down the rate to 60% of what their rate had been. And then he gave them another cue. He called to their attention the fact that they could ship poles at a lower rate if they got the poles cut in such dimensions as they could get a very much lower rate on, and then after they were delivered they could cut them into posts.

Now I am wondering if, our good friends talking about cutting off unproductive mines, is going to have any effect on mine props. The rail-

roads are not building a thousand of miles of track today. Will that have any effect on the production of ties?

MR. WARBURTON: The Boston & Maine wants to abandon 5,000 miles of their track.

MR. CLAPP: Of course if transportation goes it is going to be more difficult to get people to go into timber growing. There is also a possibility that the growing of timber will bring the transportation back. A lot of our transportation originated in lumbering railroads, railroads constructed to take out the timber. They have taken it all out now, and the railroads haven't freight enough to pay dividends.

MR. GRAHAM: They are getting 75¢ up to $1 for ties.

MR. CLAPP: More than that in most instances. A great many Eastern roads are using Douglas Fir ties from the Pacific Coast.

On the mine proposition, I know that some of the mines are having a good deal of difficulty in getting mining props. Mining timber for the Pennsylvania mines is coming from all over the country. I do not remember the exact percentage, but a surprisingly large percentage of the mining timber used in Pennsylvania comes from outside the State.

MR. GRAHAM: I am very appreciative of Mr. Clapp's remarks along this line.

The Principal Wood-Using Industries Represented in the United States National Museum.

By W.M.N. Watkins
Section of Wood Technology, U. S. National Museum.

Since addressing the Delegates to the Tenth Annual Blister Rust Control Conference on "Methods of Exhibiting Products of Wood-Using Industries", I have been requested to prepare an article recapitulating my talk in the Section of Wood Technology on February 18. I am glad of this opportunity to include a few figures which I hesitated to give on date mentioned above. Figures, orally stated, are soon forgotten, and, realizing the difficulty of taking notes while standing, I decided to omit them. However, they serve, as nothing else can, to show the importance of a wood-using industry from a lumber consumption standpoint.

Although White Pine is the tree uppermost in the minds of Blister Rust Control men, it is well to be familiar with the status of the other principal commercial species in comparison with it and to know some of their uses and limitations as well. The following 1923 lumber production census will serve as a basis for approximate comparison of the seven kinds of timber showing an annual lumber cut above one billion board feet.

Yellow Pine	19,948,687,000 bd. ft.
Douglas Fir	8,222,860,000 bd. ft.
Western Yellow Pine	2,804,632,000 bd. ft.
Oak	2,027,704,000 bd. ft
Hemlock	1,872,739,000 bd. ft.
White Pine	1,571,598,000 bd. ft.
Red Gum	1,016,279,000 bd. ft.

If the cut of Sugar Pine, (228,556,000 board feet) which is one of the commercial five-needle pines, be added to that of White Pine, the latter would be brought up to 1,800,154,000 board feet, much closer to Hemlock

in fifth place. During the early period of lumber production in this country, White Pine held the leadership, but it has gradually dropped to its present position. Be that as it may, the insidious whispers that may be heard among carpenters, etc., as to the inability to obtain the so-called "original" White Pine now are due to ignorance of the facts and not to any desire to "freeze-out" this species from the trade. I have found carpenters repeating above rumor while working on a piece of Pinus strobus. Upon questioning them, they stated that they guessed it was some of that Oregon pine. When told that "Oregon pine" is one of the various names under which Douglas Fir is sold, and that the piece they were sawing was the very wood they regarded as unobtainable, they winked slyly at each other, doubtless humoring their informant by not contradicting him.

White Pine is still a big factor in the lumber trade of this country, and, although it will not be used as recklessly as in the past, it will for some time to come hold a prominent place where exacting qualities call for its use, as in the manufacture of matches and of patterns in the foundry industry, etc. But you men need no persuasion to act toward the judicious use of the timber with which you are daily working, and I will pass on to the main theme of this article.

The Section of Wood Technology exhibits products of the wood-using industries both by industries and by kinds of wood. Some woods have been featured in the trade more than the industries in which they are used. The names of these woods are given the most prominent place in the exhibit. On the other hand, the industry may be better known than the wood or woods used therein. If so, the name of the industry is

given on a central label. The industries will follow in the order in which they rank with respect to wood consumption.

Planing mill products, sash, doors, blinds, and general millwork is the combination term for the industry which uses more lumber annually for finished products than all the others combined, namely over thirteen and a half billions of board feet. Planing mill products are flooring, ceiling, siding, etc., manufactured in connection with a sawmill operation. Sash, doors, blinds, etc., are generally made in wood-working plants situated near the regions of greatest consumption.

In the Wood Court are shown four items from this group, flooring, siding, finish, and doors. The flooring is in panel form and of edge-grain Southern Yellow Pine, noted for its wearing qualities. The siding is in several standard patterns and is clear Redwood, remarkable for its durability in contact with the elements. The finish, or interior trim, is also of Redwood. The doors, eight in number, are products of the Paine factory at Oshkosh, Wisconsin. They are built up from small stock, much of which is White Pine, and faced with veneer from such woods as Circassian Walnut, Prima Vera, Brown Ash, Red Birch, and quartered White Oak. A large pair of entrance doors complete the exhibit. One side is hand-carved, the other inlaid with Ebony and Holly.

The pulp and paper industry is represented by both a model and an exhibit. The model, made in the Museum, is of no particular plant, but is typical of a modern sulphite process mill. The exterior operation is carried from the forest, where pulpwood is being cut, to the shipping room of the paper plant.

Most of the pulpwood consumed in this country is spruce and is reduced to pulp by the sulphite process. Of the 5,548,842 cords of all species consumed in 1923, 2,162,848 cords were domestic spruce, and 2,765,279 cords were reduced by calcium bisulphite.

The exhibit proper is from the Hammermill plant at Erie, Pa., which uses the sulphite method. It is arranged along three lines. At the top is shown the process of manufacture. Each step is shown both by a specimen and by a photograph of the machine used at that particular stage. Spruce wood, barking, chipping, acid manufacture, digesting, screening, bleaching, beating, refining, the paper machine, and a roll of finished paper are shown in order. The second line contains auxiliary materials, such as lubricants for the machinery, chemicals for water purification and softening, a fine lithograph of a paper machine, colors used in paper tinting, etc. The third line is strictly quantitative and shows the exact amounts of materials that are consumed in the manufacture of 100 pounds of Hammermill Bond.

In connection with the pulp industry is shown a collection of the products of the Drake Process, of Cleveland, Ohio. By this process containers of varied shapes and sizes are made direct from wood pulp, eliminating the expensive paper-mill operation. The pulp is blown into a mold and the moisture passes out through the mesh walls leaving the articles nearly dry. Such articles as single service milk bottles, tea, coffee, and spice cartons, unbreakable dolls, copper-plated steam floats, and many others, are now on the market and new molds are continually being added.

The wood entering into vehicles and vehicle parts annually amounts

to about 800,000,000 board feet. Our exhibits show merely wood wheels. One case is given over to the spoke-type, a Ford automobile wheel being on one side contrasted with a Hickory wagon wheel on the other. It is interesting to note that the automobile wheel is assembled just the reverse of the horse-drawn wheel, the spokes of the latter being driven into the hub, except in artillery-type wheels, and the wood felloe put on after the spokes have been cut to height and round tenoned. In the automobile wheel the felloe is dressed and finished, the spokes are driven into the felloe, and the two halves assembled into a perfect wheel ready to be turned off to receive the permanent felloe band.

A third type, the Smith Woodisk wheel for motor cars, is made of laminated wood. The heavy-duty wheel is of uniform thickness, while the pleasure-car wheel has a curved surface to conform to the lines of the metal disk wheel. It is said that these wheels are five times as strong as spoke wheels against side stress (skidding).

A very important and little understood industry among those which utilize forest products is that of wood distillation. The plants situated in forest regions are seldom visited by the public. The raw products are in most cases sold to refiners, hence one hears little of the industry which produces them. In 1921 distillation consumed 482,503 cords of wood, 433,223 cords being of hardwoods and 49,280 cords being of so-called softwoods.

Over fifty products of hardwood distillation, received through the National Wood Chemical Association, are shown on an irregular pyramid, arranged in the order in which they are derived. Maple, Beech, and Birch, the most important woods in the industry, are at the top. Then come the

three primary products, pyroligneous acid, or crude wood vinegar, wood tar, and charcoal. Branching from these, their primary derivatives and a few of the most important compounds are shown.

Longleaf Pine is the most satisfactory species used in softwood distillation and is the one exhibited on an adjacent side of pyramid mentioned in preceding paragraph. In hardwood distillation most of the valuable products come from the pyroligneous acid. In softwood distillation, this acid is almost a waste product, wood turpentine, pine oils, etc., forming the valuable derivatives.

We have selected Black Walnut, which is our most valuable native wood, to represent the veneer industry, although it ranks (1923) eighth in amount of wood consumed. Veneers are either rotary cut, sliced, or sawed. In the rotary process, a log is turned against a stationary knife. By far the greater part of our veneers are made in this way. Slicing depends on bringing the wood rapidly downward against a very sharp knife, and is the most conservative of raw material. Sawing tears the fibers of the wood less, and, although very wasteful, brings out fine figure to better advantage. A half-rotary process is also in use which produces effects similar to slicing. Specimen pieces from all these processes are shown. One phase of the industry not generally known is that old Walnut stumps are being grubbed out and cut into the very finest figured veneers for matched panels.

There is also shown a single panel of figured, quartersawed Red Gum veneer, matched for design. This species in 1923 made up nearly 33 1/3 per cent of the domestic wood total consumed by the industry. It will be recalled that our door exhibit contains nearly all veneered prod-

ucts, hence it has a close connection here as well.

The average person might not give handles a very important place either as subjects for exhibition or as consumers of wood. The fact remains, however, that the handle industry is in ninth place among those manufacturing wooden products. Hickory and Ash are the two leading woods used, the former comprising nearly 43 per cent of the total. Maple is a close third. Our representation of the industry includes ninety-six specimens of sixty-two kinds of handles for seventeen different uses, such as for axes, hatchets, hammers, saws, pitchforks, etc.

The manufacture of round matches is an industry which should be of special interest to men engaged in blister rust control. They are made from the very best grade of straight-grained wood of the commercial white pines. In the process represented here, each piece fed into the match machine is inspected on all sides, and any knots or cross-grained wood is cut out. The splints are cut by dies arranged in gangs. These dies each cut one splint at a stroke, and, when returning for another stroke, "set" the splint, which has passed clear through the hole in the cutting die, in a hole in the match plate. The plates are carried along a track through a compartment filled with a powder or dust which renders the splint free from afterglow. They then travel through a tank of melted paraffin, over a roll from which they get their first dip or head, and on and on to dry. Another roll puts on the second dip or tip, and when the matches have traveled until dry they are punched out into a trough and travel therein to the box-filling machines. The match is never touched by hand; every operation, even the wrapping, is done by machinery.

The United States uses more than 1,500,000,000,000 matches made

of wood every year. This is about 37 matches a day for every man, woman, and child in the country based on a population of 110 millions, or 4 billions daily. Recent statistics from Europe have placed the per capita consumption there at 14 matches a day. The world output costs $200,000,000 and reaches a total of 4,675,650,000,000 matches a year.

Pencils are included under professional and scientific instruments and consume approximately 57 per cent of the lumber credited to the industry as a whole. Red Cedar is the wood demanded by the highest class of pencils, while Incense Cedar is largely used for the cheaper ones. Substitutes for these woods might serve the purpose just as well if it were not for the attitude of the large buyers. They have so accustomed themselves to the Cedar pencil that one of the first things they do is to smell it. If the strongly characteristic odor is lacking they will have nothing to do with it.

"Lead pencils" of today contain no lead. The marking substance is a mixture of clay and graphite, the former being used as a binder for the latter and to harden the product. After being washed, filtered, and crushed, this mixture is placed in steel cylinders and forced through a sapphire die the gauge of the required lead. It is then rolled, straightened, and cut into pencil lengths. After baking and waxing the leads are inserted in the cedar slats.

The name "lead pencil" simply conforms to the popular belief that the writing medium is lead. Real lead pencils were formerly made by pouring molten lead into a quill or hollow reed. The name is the only remnant of this old procedure.

The importance of the industry is shown in the fact that it uses

annually between twenty and twenty-one millions of board feet of Cedar, the f.o.b. mill value of which is a little over a million dollars, to say nothing of the value added by manufacture, nor of the rubber from the rubber tree, nor of the graphite, an allotropic form of carbon, believed to have once been coal derived from wood. About 1,000,000,000 pencils are manufactured from American wood every year. The average pencil costs about five cents, which means that the billion pencils represent a total value of $50,000,000 annually.

The wood going into sporting and athletic goods amounts to over twenty-five millions of board feet annually. Hickory, Maple, Elm, Ash, and Oak are the five leading woods. We have two exhibits of indoor and one of outdoor equipment. The first indoor exhibit contains a miniature billiard table of African Mahogany, inlaid with ebony and Mother-of-pearl. A championship cue, with Baywood butt, Maple top, and inlays of various cabinet woods, shows the beauty of this type of wood-turning. There are also a section of a bowling alley, and ten and duck pins of Maple, and bowling balls of Lignum-vitae.

A second case of indoor athletic equipment contains sixteen styles and weights of Maple dumb bells and Indian clubs, a Hickory trapeze bar, Maple calisthenic wands, Ash and Maple bar bells, and indoor ball bats of White Ash. Three of the five leading woods mentioned in foregoing paragraph are represented here.

The exhibit of outdoor sporting goods is made up of series showing the steps in the manufacture of a White Ash baseball bat and tennis racket, a golf driver with Hickory shaft and Persimmon head, a miniature vaulting and jump standard, and a miniature "official Olympic" hurdle. Most of

these were designed to show the exacting uses of a certain kind of wood where no substitutes of like qualities have been found. Consider for a moment the use of White Ash in baseball bats. No other wood is available which so nearly perfectly combines strength and resiliency with moderate weight for this purpose. Hickory is in use to a limited extent, but the average player desires a lighter wood. White Ash in the bows for tennis racket frames and Hickory shafts and Persimmon heads for golf drivers are further instances of exacting uses in places where the wood selected is subjected to severe strains and called upon to give the best that wood can give.

There are three other industries represented in our collections which demand exacting qualities of the woods used therein, namely fire-arms, artificial limbs, and airplane propellers, and they will be briefly discussed together. The stocks, fore-ends, and hand guards of high-grade firearms are almost never made of anything except Walnut when it is obtainable. When once turned to shape, the wood parts must always retain original lines. If distorted by checking or warping, pressures are set up against the gun barrel which lead to inaccuracy. For artificial limbs English (white) Willow wood grown in this country is supreme. The qualities demanded are lightness combined with strength, ease of working as they must be hollowed out, and lack of shrinking and swelling after seasoning. Airplane propellers call for a wood with the ability to stay in place during atmospheric changes, that will not bend or split readily, and that is hard enough to resist wear. Black Walnut is probably the best native species for this purpose. This is one of the most exacting uses of wood as human life depends on its power to fulfill the demands made upon it.

In the paragraph introducing the wood-using industries, it was stated that some of our exhibits are labeled according to the wood used. The most conspicuous among these are: Products of American Walnut, Products of California Redwood, and Balsa.

The main Walnut exhibit has already been discussed under the veneer industry, but several items of interest remain. Three designs of parquetry flooring are shown, namely, Fontainebleau, Haddon Hall, and Decking. The first received its name and was made famous through its exclusive use in the finest apartments in Fontainebleau Palace, Versailles. With slight modifications, this pattern was afterwards used in many other French palaces and has been used in some of the finest residences in the United States. The second is a reproduction of the flooring used in the hall of the Tudor Family in England, the romantic history of which was brought out by "Dorothy Vernon of Haddon Hall". The Decking idea came from the floors laid in some of the old manor houses in England. This flooring was of planks of varying widths which eventually warped badly, leaving cracks between the boards. These cracks filled with dirt and the dark crack line in the Decking specimen is an imitation of that idea. The planks were often held in place by wooden pegs and the plugs seen in this design convey that idea also.

An automobile steering wheel, Cadillac type, which shows a departure from the ordinary, is also present. In this weel the "spider" as well as the rim is of Walnut, beautifully finished in dark brown. The use of wood instead of metal in this part adds a touch which one can appreciate only by viewing it.

Two uses of California Redwood, siding and interior trim, were

mentioned briefly under planing-mill products. There are seventeen patterns of siding and fourteen finishes of interior trim exhibited. The latter are exquisite. Sawed grapevine stakes, which are merely rough squares of different length, are included since they are largely made from this wood in California. The balusters, newel post, and table legs shown are sometimes made in a combined planing-mill and factory, but are products of the turning lathe. It is regretted that two of Redwood's largest uses, outside of planing-mill products, etc., namely, pumps and wood pipe, and tanks and silos, are not included. Completing and enhancing the Redwood case are five fine pictures of these tree giants in their native habitat.

Balsa, "the wood of little weight and much usefulness", is one of the most recent to be exploited. It comes from species of Ochroma, trees very common and conspicuous in Tropical America. It is the lightest wood known. Its weight per cubic foot is ordinarily about eight pounds, but may be as low as four pounds, while cork weighs 13.7 pounds per cubic foot. Spruce wood weighs about 37 pounds per cubic foot, and, as treated, the strength of Balsa is estimated as being half that of Spruce. A piece of Balsa, 35" x 3.5" x 2.5" weighing one pound and one ounce, is shown beside a piece of Quebracho, 2" x 3" x 4" also weighing one pound and one ounce, and forms a very amusing contrast.

The wood is very resistant to the passage of heat because it consists of many tiny, uncommunicating, thin-walled cells which are true dead-air spaces. A patent container present is described as having the ability to keep a quart of ice cream firm for five hours in an outside atmospheric temperature of 75° F.

There are many more uses of this extraordinary wood a few of the more important of which are life rafts, buoyants for water sports, insulation for all kinds of refrigerated spaces, packing of highly polished furniture and metal parts, stream lining for airplanes, and hydroplane pontoons.

In closing let me add that the foregoing makes no attempt to cover the wood exhibits of the National Museum. Nor are the industries fully described. As much as is here presented might be written for an exhaustive treatise of any one of the individual subjects. May these few facts incite a desire for further knowledge of the basic wood-using industries, and to promote the use of the proper wood where wood is best. If these be done, the writer will have been amply rewarded.

F A R M F O R E S T R Y

Farm Forestry Extension in Relation to the Control of White Pine Blister Rust.

By George H. Collingwood
Extension Forester, U.S. Department of Agriculture.

Agricultural and forestry leaders realize that an adequate agricultural program must be focused upon the complete use of all land. Much land that is not now used for agriculture may grow trees. Therefore, forestry is part and parcel of any such program. The general object of the forestry extension work is to demonstrate the value of careful forest practice as a part of farm management. It may be further said that it is to establish forestry as a part of the agricultural practice of the nation.

The Clarke-McNary Bill, which was passed by the Congress of 1924, made possible appropriations of funds for forestry extension and for the growing and distributing of forest planting stock. This money will be allotted only after the state has made satisfactory arrangements for the expenditure of an equal amount for the same purpose.

Farm forestry extension work has been incorporated in the agricultural extension program of ten states, namely: Georgia, Iowa, Maine, Maryland, Michigan, New York, North Carolina, Pennsylvania, South Carolina, and West Virginia. Serious consideration and tentative plans for similar work are now under way in Connecticut, Massachusetts, Minnesota, New Hampshire, New Jersey, Vermont and Wisconsin. This active consideration of forestry by the agricultural colleges is due partly to the generally increased interest in our forest problems but primarily to the stimulus of the Clarke-McNary law. Further development awaits an official interpre-

tation regarding the distribution of these funds dealing with education.

In considering education in farm forestry, it is well at the outset to think of the method by which the work will be carried on. One way is through the efforts of a number of trained foresters who will plan to give personal service to the owners of woodlots, and another is by means of those methods which have characterized the work of the Extension Service. Under this latter plan an Extension Forester would give less time to individuals but more time to groups. By working through the county agents he is able to affect and influence a much larger number of woodland owners. Such a plan contemplates the use of demonstrations, but the demonstration is by no means the end and all. It must be remembered that the real goal is to effect a change for the better in agricultural practice of a considerable proportion of the country. Therefore the results are measured in men influenced, trees planted, acres of woodland upon which careful management is practiced, or some similar tangible units.

In order that a demonstration may have a far-reaching effect upon the community, it must first offer a solution to some problem, - it must promise to meet some felt need.

What are the felt needs for which forestry offers a solution? Roughly, they may be divided into those which affect the standing timber, and those which involve the better or more complete utilization of land.

In starting a project it is necessary to be specific and to reduce the needs to their most simple elements. This accomplished, the leaders must determine where these more elemental needs are most keenly felt. The areas may well be located, and, if possible, set forth upon a map.

10. Information and Advice.

Numerous requests for information are received daily in the Department of Agriculture and are referred to the proper bureau and office for reply. Agents in blister rust control work who may be seeking information on agricultural subjects other than blister rust control should feel no hesitancy in writing to the Department of Agriculture for that information.

Bear in mind that you represent the Department of Agriculture to the people of your state. Many questions will be asked you other than those relating to your particular work. Suggest to the questioner that he apply to the Department of Agriculture for information, or for publications when you cannot answer the question satisfactorily.

11. Cooperation with Other Bureaus.

While our task is that of working out local control of the blister rust, when this is to be carried on in National Forests or Indian Lands, you will need the assistance and cooperation of the Bureau concerned. This can generally be secured informally by interesting the Forest Supervisor, or Superintendent; but perhaps better by taking the matter up with the Washington Office which will arrange for the cooperation with the different chiefs of the Bureaus.

II. Superintendent of Documents.

When the supply of publications at the Division of Publications of the Department of Agriculture, or at other Departments, is exhausted, publications may be secured from the Superintendent of Documents, Washington, D. C., at cost. The Superintendent of Documents has for free distribution 46 price lists of its publications listed by subjects, as: #41 Insects, #43 Forestry, #44 Plants, #53 Maps, etc. It is advisable to get the price list and to learn "How to Remit" before writing for particular publications.

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With this data before one it is comparatively easy to determine a method of action.

In thirty-four states there is a State Forester or a similar officer. His duties are very largely administrative and regulatory. To a considerable extent he has police power, as well as certain educational functions. The extent of their organization varies with the state. Some are relatively complete, while others have been but meagerly thought out and developed. In any case, the State Forester should be of material help in getting the initial information. Additional information may be gathered through the county agricultural agents.

Such was the case in the very intensively organized State of New York where maps and questionnaires were distributed among the county agents, who in turn presented the subject to their community leaders. Most of the local people made conscientious efforts to answer the questions and show on the county map the areas where the particular problem was most acute. In this case, the information dealt with waste land and reforestation. The result was in the nature of a battle map for the county agent and forestry specialist. Most important of all it centered in the minds of a number of the local leaders the burden which they and their neighbors were assuming in the vast acres of unutilized land.

Once having secured this information it is comparatively easy to determine the course to be followed. It is possible to present the problem to the general public in a way that will commend their attention and confidence. Lectures, field meetings, tours, newspaper publicity, magazine articles, all focus the attention of groups of individuals upon the problem and build up the feeling of confidence which is so necessary.

Perhaps, basic to all of this is the demonstration where farmers and their neighbors may be shown how the thing proposed is actually done.

Even that is not enough! Some form of getting action on the part of the rank and file must be determined upon. We will assume that you have set forth the situation and made people think. You may have stirred to a certain extent their emotions. But probably you have reached only the point where they say "This may be important, but what does it mean to me? I have already built my house and I will be dead before any trees that I may plant will ever be large enough for the saw."

Your problem now is to break down this idea and secure action. To do this you will need to appeal to some basic ideals of the individual. What will it profit him as compared with the possible annual crops, or perhaps in terms of bonds? If he has children how may an investment in forestry be made to affect their lives? Is it comparable to life insurance? Sometimes the owner's interest can be secured on the basis of the beauty of the growing forest.

Then there is the group which may be appealed to. Groups are made up of individuals so that the appeals are much the same. There is the strong desire on the part of those who carry out the action to secure satisfactory conditions for their children. This may be of a financial character or the desire for a place for public recreation coupled with a plan for the prevention of floods. It may be to provide against an increasing scarcity of satisfactory building or fuel material.

Very often it is the desire on the part of people to get something cheap and to get it before the cost goes up. This is a common trait which can be legitimately taken advantage of. The availability of

cheap or free planting stock from the state is a case in point. In your own work, the cooperation of the Federal Government with the state to secure the eradication of gooseberries and currants has caused many landowners to come into line.

Once having made this appeal and having aroused your public to a desire for action, it is necessary to place the responsibility upon some local leaders. Here the community organization as developed under the Extension Service demonstrates its value.

Then comes the problem of continuing the recommended practice which you have so laboriously started. A leader must keep several jumps ahead of his people, but he must not get out of their sight. A program similar to the 8-year program under which blister rust control is now working will do much to provide continuous effort.

Year after year new goals should be presented until the work is finished. New projects may have to be set on top of old ones in order that the results may be of value in successive years. This is particularly true of a forest project which usually takes years for its fulfillment.

Much that I have said has been along the lines of theory, which is of no value unless it can be applied. With the help of Dr. York I have worked out a plan for certain phases of your own work. I have attempted to show how the blister rust agent, the forestry extension specialist and the agricultural agent may dovetail their efforts to the end that forestry is a definite part of the country's agricultural program.

John Doe, the county blister rust agent, finds that the farmers in his county have never thought of the woodlot as a permanent source of in-

come. Growing trees have no particular value in their minds, and the idea of investing in their protection is quite foreign. He is unable to interest them in destroying the currant and gooseberry bushes in their white pine woodlots.

After considering the matter from several angles he informs the State Director of Extension and the extension forester of the situation, and asks them to help put on a campaign of education in farm forestry. The extension forester comes to the county and studies the situation with the county agricultural agent and the blister rust agent. With the aid of the blister rust agent the other two gentlemen work out a definite plan of education in farm forestry.

The extension forester goes to Mr. Perkins, who is a prosperous and influential farmer, and who has a large stand of fine young pine. He convinces him that pine timber is as much a crop as any other product of the farm and can be made a valuable and permanent source of income. Mr. Perkins begins to realize that his woodlot represents a valuable portion of the farm and becomes anxious to know how it can be made more productive. The extension forester makes clear some of the forestry principles and gets permission to establish a demonstration in woodlot management. With the aid of the farmer and the blister rust agent, the demonstration is laid out and work started.

After realizing the importance of his farm woods Mr. Perkins is more receptive to suggestions relative to pulling the offending bushes out of his pine woods. With this background of understanding he learns soon that this is the only way to protect his pines against the blister rust and consents to have the work done.

As early as possible, arrangements should be made for a demonstration in the Perkins' woods. The development of the program and plans for carrying it forward may well be the result of the joint efforts of the extension forester, blister rust agent, the agricultural agent, and Mr. Perkins. This group, acting as a committee, should appoint a chairman to carry the plans forward to completion. Mr. Perkins might very well be the chairman and invite his neighbors, the Grange, and the members of the County Farm Bureau. The extension forester, the state forester, the director of extension or his personal representative, the blister rust agent and the State agent in blister rust control would of course attend this meeting, but Mr. Perkins should be in charge.

The speaking program should not last over an hour and should deal pleasantly with the subject before them. There might be a thinning demonstration, or at least the spotting of mature trees for timber, worthless trees such as clearly have heart rot or some defect, and "Wolf trees." Slash disposal could be demonstrated. The people can often be interested in tree identification. All should lead finally to a discussion of methods of eradicating currants and gooseberries from the woods.

After such an awakening it will very likely be an easy matter to organize a local forestry committee. If possible, do this at the meeting. Such a committee may also be the local blister rust committee.

The way is now open for increasing the scope of educational work in farm forestry and blister rust control in the county. The blister rust agent can advise and give information to woodlot owners along the lines of forestry as well as blister rust control. At the same time the extension forester is given an opportunity to learn more about blister rust control methods and their place in farm woodland management.

WHAT THE FEDERAL GOVERNMENT HAS TO OFFER THE BLISTER RUST WORKERS.

By Roy G. Pierce
Associate Pathologist, Office of Blister Rust Control,
United States Department of Agriculture.

I. The Department of Agriculture

1. Publications These are sent out without cost to special mailing lists; and upon personal requests, as long as the supply lasts, from the Division of Publications. The titles of new publications which may be desired are listed weekly in "The Official Record" of the Department.

2. Circulars, Bulletins and Reprints available at Office of Blister Rust Control.

Publications on the blister rust and its control are available from the Office of Blister Rust Control at Washington, D. C. These consist of Circulars, Bulletins, Separates from Journal of Agricultural Research, and Mimeographed copies of articles appearing in non-available publications. From time to time lists of these are sent to the field men, either in the Blister Rust News or as separate memoranda. The following is a complete list to date of this type of material.

B L I S T E R R U S T

Damage

Mimeographed sheet, Damage to Pine at Schroon River, New York.

Mimeographed sheet, Heavy Blister Rust Infection at North Hudson, New York.

Mimeographed sheet, Detailed Plot and Strip Surveys Showing Widespread Blister Rust Infection in North Eastern States.

Effectiveness of Control

Mimeographed sheet, Bullis and the Cross Pasture at Lewis.
" " Control at Chestertown, New York.
" " Control at Kittery Point, Maine.
" " Control at Norfolk, Connecticut.
" " Hayden Estate, Lake George, New York.

Motion Pictures - Titles and subtitles of the following 8 films - Mimeographed.

Film 1.	The Story of White Pine - Approximately	983	ft.
" 2.	Logging Eastern White Pine "	945	"
" 3.	Nature's Crop of White Pine "	985	"
" 4.	White Pine - The Wood of Woods "	949	"
" 5.	White Pine - A Paying Crop for Idle Lands	892	"
" 6.	White Pine - Beautiful and Useful	908	"
" 7.	Blister Rust, a Menace to Western Timber	1665	"
" 8.	The Pines	1998	"

Publications

New Facts Concerning the White Pine Blister Rust, by Perley Spaulding, Department Bulletin 116, 1914. Obtain from Superintendent of Documents for 5¢.

The White Pine Blister Rust, by Perley Spaulding, Farmers' Bulletin 742. 1916. Obtain from Superintendent of Documents for 5¢.

Report on White Pine Blister Rust Control, 1918. Bulletin 2, American Plant Pest Committee.

Report on White Pine Blister Rust Control, 1919. Bulletin 4, American Plant Pest Committee.

The White Pine Blister Rust - What it is, Where it Grows, How it Spreads. 4 page colored leaflet. Sept. 1919.

Report on White Pine Blister Rust Control, 1920 Bulletin 6, American Plant Pest Committee.

Status of Blister Rust Control in 1920-21, by S. B. Detwiler June 1921.

Treatment of Ornamental White Pines Infected with Blister Rust, by J.F. Martin, G.F. Gravatt, G.B. Posey. Department Circular 177. 1921.

Status of Blister Rust Control in 1920-21, by S.B. Detwiler June 1921.

Status of Blister Rust Control in 1921-22, by S.B. Detwiler August 1922.

White Pine Blister Rust in the Western United States, Anon. Department Circular 226. 1922.

Investigation of the White Pine Blister Rust, by Perley Spaulding, Department Bulletin 957, 1922. Obtain from Superintendent of Documents for 20¢.

How to Save Your White Pine Crop, Anon. (6 page Colored Leaflet - Jack Frost) 1922.

Report of the Proceedings and Recommendations of the Eighth Annual Blister Rust Conference, Boston, Mass., February 1923. Mimeographed.

Report of the Proceedings and Recommendations of the Ninth Annual Blister Rust Conference, Boston, Mass., February 1924. Mimeographed.

White Pine Blister Rust in Western Europe, by W. Stuart Moir, Department Bulletin 1186, February 1924.

Saving the White Pine - How Science Overcomes the Blister Rust, by S.B. Detwiler. American Review of Reviews, April 1924.

Protecting White Pine from Blister Rust, by J.F. Martin. Bulletin of the Green Section of the U.S. Golf Association, Vol. 4, No. 6, June 21, 1924.

Currants and Gooseberries, Their Culture and Relation to White Pine Blister Rust, by G.M. Darrow and S. B. Detwiler. Farmers Bulletin 1398, August 1924.

White Pine Blister Rust, in Annual Report of the Chief of the Bureau of Plant Industry for Fiscal Year Ending June 30, 1924, by W.A. Taylor. September 4, 1924.

Summary of Blister Rust Infection on Pines at Kittery Point Maine, and the Effect of Ribes Eradication in Controlling the Disease, by G.B. Posey and E.R. Ford, Journal of Agricultural Research, Vol. 28, No. 12. 1924.

Forest Practice as Influenced by the White Pine Blister Rust, by R.G. Pierce. Mimeographed 3 pages. April 9, 1925.

Status of Blister Rust Control in 1923, by J.F. Martin and G.B. Posey. March 1925.

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Control of White Pine Blister Rust in Connecticut, 1909-21. by W. O. Filley and H. W. Hicock, Conn. Agric. Exp. Station Bulletin 237, February 1922.

Help Protect Idaho's White Pine - Blister Rust.
Card of Idaho State Department of Agriculture and Cooperators.

Forest Planting and the White Pine Blister Rust, by John M. Briscoe, University of Maine Agric. Extension Service, Extension Bulletin 110, Jan. 1917.

White Pine Blister Rust in Michigan, by D.V. Baxter, Phytopathology Reprint Vol. 13, June 1923.

White Pine, a Crop that Will Pay -(10 page folder) New York Conservation Commission. May 1924.

E X T E N S I O N W O R K

Extension in Farm Forestry in New York State. Mimeographed article by G.H. Collingwood, February 23, 1923.

Methods of Building and Advancing Community Extension Programs. Mimeographed article by H.W. Gilvertson and Grace E. Frysinger, January 5, 1923.

R I B E S

Keys

The Ribes of the Inland Empire, by S.N. Wyckoff - 18 pages. 1923.

Ribes of Oregon, by L. N. Goodding - 30 pages. 1923.

The Ribes of Sugar Pine and Western White Pine of California, by S. N. Wyckoff, 14 pages. May 1923.

The Ribes of Washington, by S.N. Wyckoff. 37 pages. 1922.

Key to the Gooseberries and Currants of the Northeastern United States, by Frederick V. Coville. Mimeographed - 3 pages.

Diseases

Rust Occurring on Ribes in the West - by Ellsworth Bethel - -
This article is a part of the four preceding booklets under Keys.

Substitutes

Substitutes for Currants and Gooseberries, by George M. Darrow. Mimeographed - 3 pages. Feb. 6, 1923.

Edible Fruits Borne on Many Ornamental Shrubs, by E.M. Brockway. Mimeographed - 3 pages. 1924.

W H I T E P I N E

Diseases Other than Blister Rust

The White Pine Blight - Letter from Dr. Haven Metcalf, Mimeographed - 5 pages. March 9, 1922, Amended March 1, 1923.

Less Serious Diseases of White Pine - by Dr. Haven Metcalf, Mimeographed - 3 pages. June 1924.

Insects

White Pine Insects, by H. B. Pierson. Mimeographed - 3 pages. January 29, 1923.

Insects Injurious to White Pine, by William Middleton. Mimeographed - 4 pages. June 1924.

Management

White Pine Under Forest Management, by E. H. Frothingham, Bulletin 13 U. S. Dept. of Agric. February 29, 1914. Obtain from Supt. of Documents for 15¢.

The Management of Second Growth White Pine in Central New England, by R. T. Fisher and E. I. Terry. Mimeographed - 7 pages. April 1920.

Observations on the Management of White Pine with Special Reference to Reproduction Methods Used on the Harvard Forest at Petersham, Mass., by J. Nelson Spaeth. Mimeographed 4 pages. April 9, 1925.

Management of Farm Woodlots (with special reference to white pine) by John H. Foster, New Hampshire Forestry Dept.

Silviculture

The Relation of Gray Birch to the Regeneration of White Pine, by J. W. Toumey. Mimeographed 9 pages. Jan. 1919.

Notes on Release of White Pine in Harvard Forest, Petersham, Massachusetts, by J. Nelson Spaeth. Mimeographed - 4 pages. February 1922.

Values

Value of White Pine in New England - Table showing values of white pine per thousand board feet and per acre for pine of ages from 20 to 70 years, by E.H. Frothingham. 1924. Mimeographed 1 page.

Massachusetts Considers the Planting of White Pine a Good Business Proposition, by H. A. Reynolds - Mimeographed 1 page.

White Pine, a Crop that Will Pay. New York Conservation Commission, May 1925.

Yields

The Sustained Yield in Certain Forest Localities in Massachusetts (this relates particularly to white pine) by H.O. Cook, Chief Forester of Massachusetts. 1914.

Yield table for White Pine in Southern New Hampshire, by J. H. Foster. 1923. Mimeographed sheet.

Miscellaneous

Helpful Hints in News Writing - Webb Publishing Company.

Migrations of the Lumber Industry in the United States, by Cloice R. Howd. (Extracts from Bulletin #349, Bureau of Labor Statistics - 1923)

Motion Pictures of the Department of Agriculture. Misc. Circular No. 27.

3. Books

The loan of books and periodicals is possible, to members of the Bureau of Plant Industry, for short periods of time and, under certain circumstances.

The purchase of books for permanent field offices is possible where the necessity for the purchase is shown.

The photostatting of individual pages or articles in books and other publications is available to our coworkers in the field.

Note: All requests for loan, or purchase of books, or for photostatting should be made through the Washington Office of Blister Rust Control.

Bibliographies on forestry are now available at Forest Service, and those on plant pathology are being compiled by the Librarian of the Bureau of Plant Industry.

4. Office News Letters

There are several offices in the Bureau of Plant Industry that put out news letters, some monthly, some bimonthly. Those which may be of interest to you are the Extension Pathologist, and the Plant Disease Reporter. The Blister Rust News is sent not only to all blister rust employees, but to Forest Schools, State Foresters, and Pathologists in white pine regions, also to our Collaborators, many former employees of the Office and to others interested in our control work.

The Forest Worker put out by the Forest Service is available to all engaged in pine blister rust control. This keeps all offices engaged in any branch of forestry work in touch with other branches of the work.

5. Photographs

A collection of 2,800 photographs is available at the Office of Blister Rust Control, showing all phases of the rust and the damage caused by it, control measures practiced, various species of Ribes, (currants and gooseberries) and the different five-needled or white pines.

Through the courtesy and cooperation of the U. S. Forest Service, many of their photographs on the silviculture, management and utilization of eastern white pine, western white pine and Sugar pine have been added to the collection of our Office and are made available to our field workers.

Enlargements can be made of the above photographs on special request and in limited quantities. Enlargements will be mounted on cloth or beaver board, cardboard, or left unmounted.

The latest development has been that of mounted sets of 4 to 5 photographs, strung together vertically by tape.

The Forest Service has numerous travelling exhibits of large mounted pictures, which school teachers are using right along.

6. Lantern Slides

Numerous sets of slides, most of them colored, have already been made up and sent to each of the northeastern states by this Office. These sets are being added to from time to time as new or better photographs are received. Several sets of the Waterford, Vermont infection area have been made and are being colored.

Sets of lantern slides on various subjects are available from other Bureaus than ours; for example, The Office of Cooperative Extension Work has a collection of slides on agriculture and the Forest Service has a comprehensive collection of slides on forestry. Both loan slides for stated periods with the borrower paying transportation charges both ways.

7. Exhibits

Our Office has made up various types of exhibits from the heavy box and panels formerly used by the Office of Exhibits, to the 5-wing panels with carrying case, for the West, and 3-wing panels for the East, and the smaller pipe-box cases for Massachusetts and the little hand-boxes now being prepared for the West.

Material for less finished exhibits than the above can be furnished by this Office on request.

In proposing exhibits for state fairs and larger expositions, this Office can secure the cooperation of the Office of Exhibits.

The Forest Service has a large collection of wood specimens which are available for loan exhibits.

8. Maps

There are soil survey maps and Forest Service maps available for various parts of the country. Most of these are well known to our men. Maps can be copied, photographed, and enlarged or diminished in size upon request made through this Office.

Maps from other Departments such as Topographical sheets of the Geological Survey and Post-route maps of the Post Office should be secured through the Washington Office.

9. Duplication.

The Office has a mimeograph which is used for duplicating any typewritten statement, publication forms, etc. There is also a central duplicating office in the Department which can be called on for similar service, in multigraphing and mimeographing. This service is not now being used by the field men to any extent. "Copy" for duplication should be on hand at least 10 days before needed.

10. Information and Advice.

Numerous requests for information are received daily in the Department of Agriculture and are referred to the proper bureau and office for reply. Agents in blister rust control work who may be seeking information on agricultural subjects other than blister rust control should feel no hesitancy in writing to the Department of Agriculture for that information.

Bear in mind that you represent the Department of Agriculture to the people of your state. Many questions will be asked you other than those relating to your particular work. Suggest to the questioner that he apply to the Department of Agriculture for information, or for publications when you cannot answer the question satisfactorily.

11. Cooperation with Other Bureaus.

While our task is that of working out local control of the blister rust, when this is to be carried on in National Forests or Indian Lands, you will need the assistance and cooperation of the Bureau concerned. This can generally be secured informally by interesting the Forest Supervisor, or Superintendent; but perhaps better by taking the matter up with the Washington Office which will arrange for the cooperation with the different chiefs of the Bureaus.

II. Superintendent of Documents.

When the supply of publications at the Division of Publications of the Department of Agriculture, or at other Departments, is exhausted, publications may be secured from the Superintendent of Documents, Washington, D. C., at cost. The Superintendent of Documents has for free distribution 46 price lists of its publications listed by subjects, as: #41 Insects, #43 Forestry, #44 Plants, #53 Maps, etc. It is advisable to get the price list and to learn "How to Remit" before writing for particular publications.

MISCELLANEOUS PAPERS

Mr. C. E. Gapen gave an informal talk on "Newspaper Writing", in the place of Mr. F. M. Russell who could not be present. The gist of the talk was to the effect that many of us engaged in educational and extension work in the Department fail to realize just what constitutes good news material. News must be new, or at least interesting subject matter dressed up in new clothes.

The bringing of influential local persons into the story is much better than, say a talk on the same subject by a Department man unless the latter be a man of prominence. What the Secretary of Agriculture says on any subject is news, what John Jones says is generally not news unless he be a recognized authority on the subject.

For the small town or city papers, news should have a local slant. City papers can well take care of the affairs of the world and are invaluable, but it takes the community paper with the "local slant" to care for the intimate details of the small town. Such things as birthday parties, weddings, folks going visiting, etc., are of little value in the crowded columns of the city paper but in the community paper they serve as a bond of friendship, bringing villages together and creating neighborliness and affection within the community.

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It has not been possible to secure extracts or verbatim reports of the following informal talks:

1 - Conduct of the Bureau's Business - - - Mr. H. E. Allanson.
2 - Educational Methods - - - - - - - - - -Mr. A. B. Graham
3 - Motion Picture Work of the Department- Mr. F. W. Perkins
4 - The Work of the Forest Service- - - - -- Mr. E. E. Carter.

A T T E N D A N C E.

A.H. Amadon - State Leader, New York Conservation Commission, Albany, New York.

O.C. Anderson - State Leader of Blister Rust Control in Rhode Island, 129 State House, Providence, Rhode Island.

H.P. Avery - Chief Clerk, Office of Blister Rust Control Washington, D. C.

J.L. Bedwell - Assistant Pathologist, Office of Blister Rust Control 618 Realty Building, Spokane, Washington.

F.M. Callward - State Leader, c/o Chief Forester, Montpelier, Vermont.

J.F. Cannon - Clerk, Office of Blister Rust Control, Washington, D. C.

J. M. Corliss - Assistant State Leader, c/o State Forester, Concord, N. H.

S.B. Detwiler - In Charge of the Office of Blister Rust Control, Washington, D.C.

W.J. Endersbee - Specialist, 192 North Main St., Rochester, N. H.

E.C. Filler - Associate Pathologist, 403 Appraisers Stores Bldg., 408 Atlantic Avenue, Boston, Mass.

W.O. Filley - State Leader, Box 1106, New Haven, Connecticut.

A.E. Fivaz - Specialist, Box 51, Warrensburg, N. Y.

W.O. Frost - State Leader, c/o Forest Commissioner, Augusta, Maine.

L.W. Hodgkins - Agent, 6 Anderson Street, Taunton, Mass.

J.F. Martin - Pathologist, Office of Blister Rust Control, Washington, D. C.

L.E. Newman - State Leader, c/o State Forester, Concord, N. H.

L.H. Pennington - Forest Pathologist, New York State College of Forestry, Syracuse, New York.

C.C. Perry - State Leader, 136 State House, Boston, Mass.

Roy G. Pierce - Associate Pathologist, Office of Blister Rust Control, Washington, D. C.

G.B. Posey, Associate Pathologist, Office of Blister Rust Control, Washington, D.C.

J.E. Riley, Jr. - 425 Whalley Ave. New Haven, Connecticut.

H.H. York - Pathologist, State Conservation Commission, Albany, N.Y.